POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XVI FEBRUARY, 1935 Number 2

NRA CODE

TABLE OF CONTENTS

FEATURE ARTICLES

AN AIRY CHAT WITH THE EDITOR 74
THE TREND IN DESIGN OF AMERICAN PURSUIT PLANES 76
THE VERSATILE ROLAND GARROS 79
SILK WORMS AND OLD PASTURES 81
HIGH-LIGHTS AND SIDE-LIGHTS 83
ELEMENTS OF THE PROPELLER 85
THE AERO-SPORTSWOMAN 86
THE WORLD'S FIRST AIRMAIL 87
THE IMPORTANCE OF CHECK-UPS 89
THE OPERATIONS DEPARTMENT KEEPS 'EM FLYING 90
AND THE DREAM-SHIPS STILL COME 94
OPERATING AT CONSTANT ENGINE SPEED 95
FEATURES OF LIGHTPLANE DESIGN 97
THE NATIONAL GLIDER MOVEMENT 99
DR. SPRATT'S REMARKABLE AIRPLANE 101
BUILDING THE CORBEN SUPER-ACE 102
WHAT OUR READERS ARE BUILDING 105
A DEHAVILAND "5" MODEL 106
BUILDING THE BEECHCRAFT B-17L 109
WHAT THE INDUSTRY IS DOING 114

PICK OF THE BRIEFS

New Meteorological Surveys in India 80
The Giant Clipper Ship Now on Test 82
A Stirring Story of a Narrow Escape 84
War Ace Learns to Fly Again 84
Pioneer Steel Plane Now in Museum 84
The International Aircraft Code 88
A Novel Navy Game 88
Speed of Army Pursuit Planes 93
Three View Details of the Curtiss A-8 93
The Humming Bird Cost Only $80 96
POPULAR AVIATION Data Sheets 98
He Sells Sign-Writing Machines by Plane 100
POPULAR AVIATION Data Sheets 100

POPULAR AVIATION, Volume 16, Number 2, February, 1935. Published monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor. New York Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year, single copies, 25 cents, foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Photos and drawings will be considered as constituting a part of the manuscript in making payment unless otherwise specified. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Additional entry at Long Prairie, Minn.

The Trend in Design of

The well-known Curtiss F9C-2.

A Naval Curtiss TS-1.

The Boeing PW-9.

by

ROBERT J. FANCL

Photographs by the courtesy of the U.S. Army Air Corps.

IT is the contention of aerial strategists that the fighting plane will evolve itself into a two-seater monoplane of low-wing construction.

At no time in the history of the Air Corps has the army tested a greater variety of types than in the last four years, indicating a drastic evolution in air equipment and air tactics. The wildcat days of experiment, from 1919 to 1923, could not show the diversity that today exists among the experimental fighting planes of the United States.

The year 1923 produced orthodox single-seater biplanes for fighters which, with little change other than increased power, remained as standard equipment until 1927. This means, in fewer words, that the evolution of 1919-1923 produced nothing.

Designs in fighting aircraft had completed a cycle and had reverted to mid-wartime standards of construction: i.e., a single-seater biplane. The evolution of today, however, bears real promise of developing types of fighting aircraft that are a close approximation to the predictions stated in the first sentence.

It is strange, after the astonishing success of the Bristol F2B two-seater fighter of wartime fame, that the merits of a two-seater fighter should be lost sight of so completely.

The navy is to be credited with the preliminary realization of the advantages of this type. This was brought about by the advent of the Curtiss "Helldiver" or XF8C-1. There exists no more eloquent record of satisfactory service-type planes than the list of purchases. Statistics show that from its inception in late 1927, until the present, 149 ships of the Helldiver type have been bought.

The Helldiver, in appearance, resembles the orthodox single-seaters of the navy, differing in that the upper wing is sharply swept back to aid in lateral stability.

At present, the Army Air Service has approved five different types of two-seater fighters, the navy has put its approval on two of this type, with four more giving performances which all available reports indicate as satisfactory.

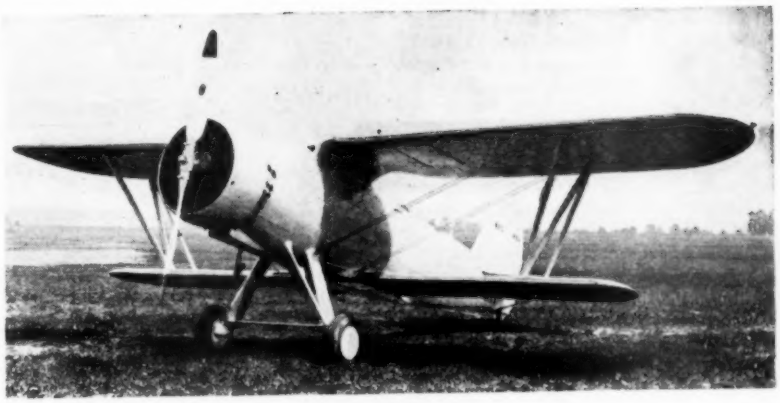
Of the five two-seater army types mentioned above it is fitting to discuss the Berliner-Joyce P-16 first, as it was this craft that first expressed the trend of army attention to the two-seater. This craft was built along orthodox lines, with the exception of the gull-wing feature. A regular gull-wing was employed above with the lower wing of inverted gull construction. This type subsequently evolved itself into the P-85, a very similar model except that a 575 h.p. Wright Cyclone air-cooled motor was mounted in place of the Curtiss Conqueror employed in the former.

The Lockheed Company, Burbank, California, then a division of Detroit Aircraft, entered the military market with a two-seater low-wing, all-metal fighter. With a sparkling display of performance this craft, the XP-24 or XP-900 and XA-9, as it is variously known, announced its possibilities. This ship represented a startling innovation in fighter design and it looked suggestively like the dream-ship of the average aviation enthusiast.

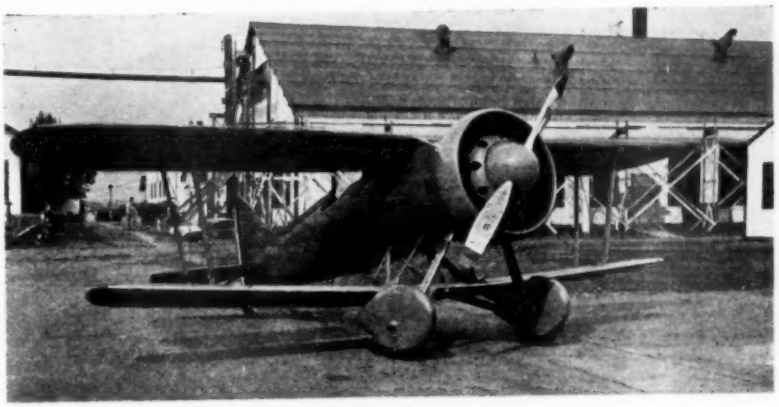
American Pursuit Planes

A VERY interesting history of the development of pursuit planes for the U.S. Army Air Corps. Pursuit plane design has been an intensive development as befits one of the most important arms of the air-service, and the various variations in detail are exceedingly interesting and instructive.

A Navy Curtiss F11C-3.



Berliner-Joyce XF2J-1.



Berliner-Joyce FJ-2.

The motor, a 650 h.p. ungeared Curtiss Conqueror, was surmounted by a three-bladed propeller. A movable glass cabin completely shielded pilot and gunner in normal flight. The radiator was placed slightly ahead of the leading edge of the wing; large wing fillets, a retractible landing-gear, and internal control horns on all movable surfaces gave the plane a clean-cut look overall.

A malignant fate seemed to pursue this design. After the original model had successfully passed government tests and eight additional airplanes of this type had been contracted for, four to carry an attack plane designation and four under assignment with pursuit groups, the Lockheed company defaulted. As a climax to these misfortunes, the original plane was wrecked by an explosion in midair which cost the life of its pilot, Lieutenant Woodring. With customary secrecy the army has withheld all information concerning the cause of the explosion and its source can only be guessed.

The Consolidated Aircraft Company, Buffalo, New York, then introduced a similar model to the army designated the XP-25. Construction in the main was identical to that of the XP-24 with the one exception that a geared Curtiss Conqueror was used, making possible a cleaner more efficient nose design.

After the successful debut of this model, the XP-30, a sister ship of the XP-25, was produced by the same company. The principal difference existing between these models is that the former is equipped for high-altitude work, with a side-type supercharger of conventional design. A single-arm retractable landing-gear is also incorporated into this model. The end of the army fiscal year of 1933 saw four XP-30 and one XP-25 types contracted for.

By the foregoing, it will be seen that the late two-seater fighters of the Air Corps are exactly the ideal fighting craft of tactical strategists. Of the navy, however, the same cannot be said. In the c.. e of the navy, allowance must be made for the fact that carrier operations issue a premium on space. This fact weighs heavily against the monoplane and its attendant greater floor coverage. Of late, this prejudice against the monoplane is being overcome.

As mentioned previously, 1927 saw the first naval two-seater fighter and dive-bomber. With its smashing success it is somewhat surprising to find that the navy accepted no other company's two-seater fighters in quantities until the year 1933 when twenty-seven Grumman XFF-1 types were contracted for.

During these years the Vought Company, Hartford, Connecticut, produced two fighters of the two-seater type, the XF2U-1 and the XF3U-1. The XF2U-1 was a single-row radial-engined biplane of the well-known Vought lines, which met with a measure of success but was not produced in quantity. The XF3U-1 is equipped with the twin-row radial Pratt and Whitney Wasp. In construction it closely follows the XF2U-1.

The Grumman XFF-1, pr.duced by

the Grumman Aircraft Engineering Corporation, Long Island, New York, is a biplane of generally conventional design. The dual cockpits are enclosed entirely by a glass cage for normal flight. The chord at the center section is deeply cut out, following in this practice other naval two-seaters. The fuselage is distinctive, with a deep belly in which are recessed the retracted wheels during flight. A Wright Cyclone of 700 h.p. supplies the power.

The advent of the Pratt and Whitney double-row Wasp motor seemed to give new impetus to the two-seater fighter and 1932 saw two of this type of ship spring into being which are known to be fitted with this engine. These are the Berliner-Joyce XF2J-1 and Vought XF3U-1. This year two other types, the XF12C-1 and XF13C-1, both of Curtiss design, are purportedly equipped with the double-row, or twin Wright Whirlwind, an engine very similar to the Pratt and Whitney double-row Wasp.

Of the four models listed above, the XF3U-1 and XF2J-1 adhere to the old tradition of the navy in being of biplane design. The XF2J-1 verges away from the accepted "tried and true" lines of former naval two-seaters, featuring gull wings similar to those of the army models P-16 and P-85. A clean-lined motor cowling and landing-gear add much to its appearance, while, in the latest of this type produced, a glass cage covers both cockpits.

The Curtiss XF13C-1 presents an interesting step — backward, it would seem—in wing construction. A parasol monoplane, the wing is held in place by a maze of struts, this giving the pilot the effect of hanging suspended in the proverbial bird cage. A deep-bellied fuselage completely covers the wheels while the plane is in flight.

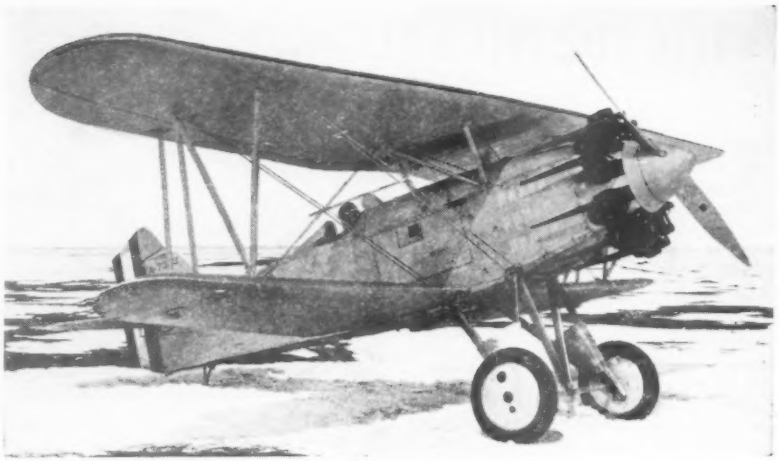
Of late, unfounded reports indicate that the XF12C-1 bears a striking similarity to the XF13C-1, but these reports are composed of such unsubstantial material as not to merit serious consideration. Despite the present trend toward the two-seater, the single-seater remains the backbone of the fighting units of both services.

Up to the present time, the Army Air Corps recognizes two divisions in its service, a high- and a low-altitude fighter. The former is exemplified in the Boeing P12-E, the latter in the Curtiss P6-E.

Paradoxically, when these models approached the obsolete stage in 1931, the Curtiss Company offered for army tests a high-altitude fighter, the XP-934, while the Boeing Company introduced the XP-936, a type which, while equipped with a supercharger and adaptable to offensive tactics at high altitudes, general characteristics indicate this plane to be a low-altitude type.

It is worth mentioning at this point that the Curtiss Company at various times offered high-altitude fighters to the Air Corps, but did n t meet with much success. The types offered were the P-5, P6-D, and P6-F. The latter is officially designated P-23, and was intended as a supplement to the P6-E. It differed from the P6-E only in that it was equipped with a side-type supercharger and the cockpit was completely cowled in by a glass cage.

The Naval Air Service recognizes no further differentiation beyond the "fighter" appellation. All planes so designated are to be acclimatable to tactical use at all general altitudes, and all are stressed for possible use as dive-bombers. The tendency of the army at present to extend a preference to the monoplanes as a fighting type is not, it seems, a new one.



Curtiss F6C-4.

Consolidated YIP-25.

Curtiss F8C-5.

During the period of 1920-1922 more monoplanes than biplanes were tested. This was due, in no small part, to the influence of the Pulitzer races of the period. The pursuit models that blossomed out in those years were carbon copies of their progenitors of the racing field.

Significantly, in 1923, two orthodox biplanes emerged from the muddle of weird vicious-looking monoplanes and biplanes to rule the military field. One model was the Curtiss PW-8, the other the Boeing PW-9.

(Continued on page 124)

The Versatile Roland Garros

by CARL B. OGILVIE

While Garros, a pioneer exhibition pilot, was one of the best known war pilots, his service during the war was more essentially the service of an inventor than that of a simple pilot. The author tells how he invented a machine gun drive that revolutionized aerial armament.

ONE of the outstanding trail blazers of French aviation was Roland Garros. He ran up an amazing record for daring and was the first pilot to accomplish many new aerial feats.

He made aviation history before and during the World War. His personal record is one of glamorous glory and tragic bitterness. His inventive genius made it possible for a machine gun to fire through the revolving blades of a propeller.

This was his greatest glory. But bitterness gnawed away the short lived glory. He fell a prisoner of the Germans. His invention was perfected by the enemy and was used to shoot down the very same French pilots Garros had designed his invention to protect.

That his comrades of the air should be killed by his invention was a pill of gall that Garros was forced to swallow. But he never forgot it. That he had shot down five enemy planes, for which he was never officially accredited—to be forever denied the honorary acedom—became a mere triviality. Perhaps his bitterness was sweetened somewhat by the knowledge that he gave, not only to France but to the air forces of the world, the basic idea for a mechanism that made possible the glory of acedom for hundreds of valiant airmen. Yet Garros has never been listed as one of them.

Long before the World War, Aviator Roland Garros became famous throughout Europe and the United States as a skillful exhibition pilot. He won first place in the great European Circuit races; the race from Paris to Rome, and the race from Paris to Madrid. In 1911 he was first in the Grand Prix d'Anjou. As a racing pilot he was the Jimmie Wedell of his day. No other European aviator could match his skill and daring. He could outfly any and all speed competitors.

That same year, he flew in the United States. He was one of the first French aviators to fly in America, thrilling awed spectators with daring aerial exhibitions. He then went to Mexico. In a demonstration over Mexico City Garros bombarded a Mexican artillery battery with oranges and forced the orange juice-spattered soldiers to take hastily to cover.

In 1913, the slight, dark haired French pilot decided to be the first man to fly from Europe to Africa. This meant piloting a plane over the broad expanse of the Mediterranean Sea. To plan such a flight was then as daring as it seemed impossible of success. Garros would certainly be drowned French officials agreed. But he took off from St. Raphael, France, headed south over an expanse of blue sunlit water. He landed safely at Bizerte, Tunisia, North Africa. Thus Garros, who was destined to win greater glory, won fame for being the first airman to fly across the Mediterranean Sea.

In 1915 Garros was to perfect his machine-gun fire control invention and become the first pilot to fire through a revolving propeller.

Later he won notice for being the first Allied flyer-prisoner to escape from Germany to England.

The summer of fateful 1914 Roland Garros was in Germany. One evening a tremor of excitement ran through his slight body when he read the start-

A sketch of Roland Garros, war-time pilot and inventor. He was never officially proclaimed an ace, but he was an outstanding figure during the war.

ling newspaper headlines that German troops had invaded his beloved France. War! And he had for years been pointing out the military value of aviation for observation and bombardment work. His views were as well known in Germany as he was. He was an alien in a country that was at war with his native country. He realized that he was in imminent danger of being arrested and interned for the duration of the war. This was unthinkable. He must manage to get out of Germany at once. He must get back to France to fly for his country.

How he was to manage to get back was not easily decided. In every street, every doorway, danger of arrest might be lurking.

It was night. Garros left his quarters immediately, not daring to take the few minutes necessary to pack his bags. He hurried through the streets avoiding public places where he was accustomed to meeting friends. Hat low over his eyes he got past the scrutinizing gaze of an officer at the railway station and was the first Frenchman to get out of Germany by the way of Switzerland.

Back in Paris, Garros immediately reported for active service. He was sent to the military center at Saint-Cyr where he got his "hand-back-in" on the light military monoplane. With Armand Pinsard, who later won 27 official victories, Garros took off for a reconnaissance. Flying their own machines they completed their flight and returned to Paris to await orders to active duty.

At Buc, Escadrille M. S. 23 was being organized. Ordered there, Garros was delighted to find himself among many of his old friends—the most famous airmen of France—Pegoud, Vedrines, Pinsard, Eugene Gilbert and Marc Pourpe. The latter was the only French pilot to have an American mechanic. Later the American became the only American to serve as a pilot in the French Air Service other than the Lafayette Escadrille. The mechanic's name was Raoul Lufbery.

Garros, with this famous group of pilots, was rushed to Breteuil in September, 1914. The German infantry was but 25 miles from Paris. The French Army was in retreat and the capitol of France was in imminent danger of being captured. Every available French plane and airman was urgently needed at the front to gain sadly needed information of the Germans' strength and movements.

Along the Marne, French pilots in flimsy little Morane "Parasols," vied with the equally delicate German Taubes. They made many scouting flights and reported their observations of hostile troop movements, artillery activities and their positions. The information was valuable to the French General Staff in planning a heroic resistance that blocked the Boche and saved Paris. Garros and his comrades did their full share in helping to turn the Huns' advance along the Marne into a crushing retreat.

In October, the military intelligence was that the German High Command had established headquarters at Thielt. Garros conceived the idea of a bombardment raid on the headquarters. It would demonstrate to the French and Germans alike the efficiency of the French Air Service. It would also force the enemy high command to con-

sider more seriously the menace of the French Air Service.

Garros, with Pinsard and other pilots, took off. As they flew over the German trenches and into Hunland they had no way of knowing that Kaiser Wilhelm was paying a visit to the German Army headquarters. Garros never knew until some time later how perfectly he had timed the bombardment flight.

The French pilots swooped down on Thielt. Down came their bombs. Bamb! Boom! Bam-m-b! And the imperial mustachio of the Kaiser went up as his face paled with alarm. Without waiting for his customary swanky aides to accompany him, Wilhelm dashed from headquarters to his waiting automobile and quickly sped to regions less dangerous. This incident, in which the Kaiser got his worst scare of the war, was perhaps the cause of his violent dislike for all French pilots.

Later, during that Fall month, Pinsard fell behind the German lines and was taken prisoner. Garros missed his buddie. He and Pinsard had accomplished some brilliant reconnaissance and artillery spotting missions together. Garros' heart was heavy. He struggled with wild, vague plans of flying into Hunland, releasing Pinsard from the prison camp and flying him back to France. To accomplish this reckless and impossible feat Garros realized that he, as well as his plane, must be efficiently armed.

Up until this time the airplane had no adequate means of defense. Crude experiments were being made with brickbats, rockets, revolvers and carbines, but none proved effective. Forcing down a plane had been more luck than skill. The consensus of opinion was that if a machine gun were to be mounted on an airplane its weight might make it unmaneuverable and certainly the vibration of its recoil would pound the airplane to pieces.

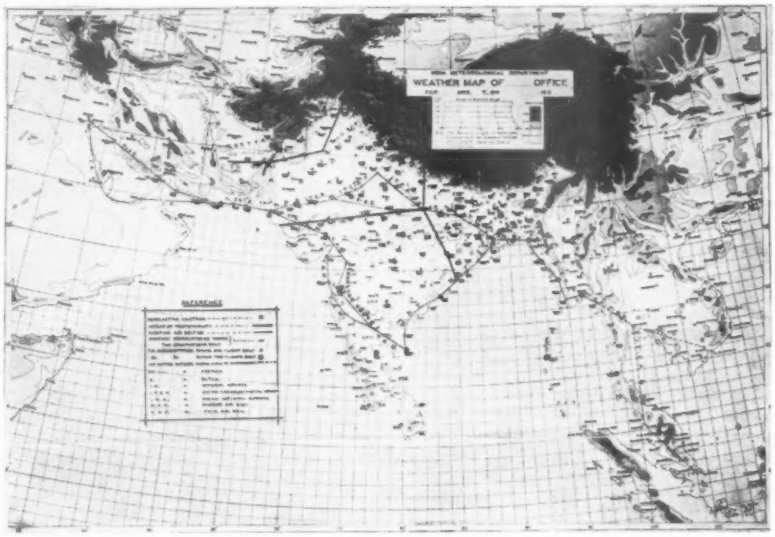
But Garros decided there *must be some way* to arm an airplane. He set himself to the task of determining the method. He spent long hours of an evening in the armorer's office. Here he poured over statistics of machine guns, their weight, action, recoil, etc. He studied the rate of fire per minute, compared it with the revolutions of an airplane propeller. Within Garros' brain was budding the idea for one of the most important inventions during the war—a method by which a machine gun could fire through a revolving propeller blade.

While Garros was making his research and sketching crude plans, the first planes armed to defend themselves appeared at the Front. A few "pusher" British ships had appeared with Vickers machine guns installed. Some captured two-seater German ships were armed with movable parabellum guns fired by the observer-gunner.

And now the French, who had invented the machine gun and first used it in warfare against the Prussians in

(Continued on page 122)

New Meteorological Surveys in India



A reproduction of a typical weather map made by the Indian Meteorological Department for the use of aircraft.

WITH the development of civil and military aviation in India and their unusually rapid growth, a demand has arisen for meteorological information as a direct aid in the proper operation of air facilities.

Between 1927 and 1930 the regional forecast centers in India, which were particularly concerned with aviation, prepared two weather charts a day. New instructions for observers and new registers for observations were developed and introduced so that now practically all of the observatories in India and Burma and also at stations along the Persian Gulf and Mekran coasts are prepared to send out meteorological information of value to aviation.

The opening of a new chain of wireless stations along the air routes has made available services to supply information on actual weather conditions at neighboring stations. Stations taking part in this scheme are Karachi, Jodhpur, Delhi, Allahabad, Calcutta, Chittagong, Akyah, Sandoway, Bassein and Victoria Point. Aside from routine observations at stated times it is possible for flyers to obtain information of current local weather at any time by wireless.

As fast as financial conditions allow the Indian Meteorological Department intends to carry on many developments of value. They plan to extend the current weather reports on the wireless chain along the Trans-India air route by including immediate reports of adverse weather, transmitting upper wind information and will send out twice daily at regular times weather forecasts for each part of the route.

A skeleton weather service is to be organized on the Karachi-Bombay-Madras air route and the general improvement of the skeleton weather services along all the routes. It is also intended that there shall be developed an exchange of synoptic weather data by wireless with neighboring countries such as Siam, Malaya and Indo-China.

To aid in the completion of the series of "continental" weather broadcasting stations at Annapolis, Rugby, Moscow, etc., in the northern hemisphere the Department plans to broadcast a "continental" bulletin of synoptic weather data for the region from Persia to Indo-China.

For years, the Indian Meteorolgical Department has carried on important investigations into various phases of tropical weather conditions. These findings have had world-wide acceptance and are of greater interest now that the department is expanding.

Probably the best known and most interesting work done by the Indian meteorologists were their investigations into the nature and behavior of electrical storms, the cause of lightning and the various phenomena accompanying lightning. These experiments continued over a long period of time and are most comprehensive tests yet made. The condition of the electrical charges in the air during such storms, the polarity and voltage of the discharges were all subjects thoroughly discussed.

Very recently, study of atmospheric currents with their influence upon soaring bird flight and sailplanes was on the program and glider experts were invited to partake in this work. This Indian institution has a long and honorable history behind it that larger bureaus can regard with envy. All of this data, collected for so many years, will be of great value now that commercial aviation has entered into the domain of India.

Silk Worms and Old Pastures

by T. R. WISEMAN

Tales of the old air circuses that barnstormed the country in the days of Jennies and Standard J-1's. Days that were filled with romance and daring exploits—mostly for "coffee and."

THE young crew who rode the wind and reaped the gate receipts of the old air circus days, like the young cow-pokes of the old west, cared very little for tomorrow's sun.

Like the early cowboys they were a product of a war. Their creed was "Manana"—"tomorrow never comes." They lived today. Most of them, like those same cow-pokes, died in the saddle—"with their boots on."

The few who are left are those who learned that care for today would bring another sunrise—just as a few of the wild youngsters who rode the range learned that a reputation for quick-shooting was a poor thing to carry and hard to keep! It was an irresistible temptation for some hombre to gain a name for being quicker.

But the air circus is dead. I recall the first one I saw and I mourn for it, with that other glamorous stripling, the old—old west. Together they have found the smoother lanes of commerce. No longer does the winged steed of the sky fly wind currents bridled only by the imagination and temperament of his rider.

Progress has harnessed the bright creature and he must develop or perish. Safety in the air is the watchword and stunt flyers have planted their props and gone into business, or have gone to the happy hunting grounds of those who know no morrows.

I was ten, the summer the first air circus came to town. The calliope had steamed its enchanting tune. From long distances out on the dusty roads, people in farm wagons and tin Lizzies saw the wheelings and cavortings of stunt planes in the sky. Through all the excitement of a balloon race, I clutched the hard-earned coins tightly I had saved for a ride on that "death-defying plane."

Nearing the end of a long drop, and attempting a "spot-landing."

Although I held my breath while the wing-walker stood perilously on his fragile support, slipping and clinging to the edge as the barker near me dramatized danger by his chant of:

"He's up! He's down—he's gone—he's climbing back—he's up—he's safe—down—down—down! He's up!" Even then I never lost sight of that final major attraction—a ride.

Keen rival of the daring intention in my mind, however, was the parachute jump—discussed for weeks at home. My brother and I had a wager. He was sure a dummy would be used for the jump and I knew—verbally and vociferously—that it was to be a real man. But the waiting was long—for the wind was high and the jump postponed until sundown.

At last, when every small-boy heart had despaired the parachute jumper climbed into a plane.

Soon we could just see the plane, like a fly crawling high on the blue ceiling. While our eyes strained and our hearts pounded in a sympathetic anxiety, the pilot maneuvered for a favorable position. ("Suppose he should fall right into the crowd?")

Then, slowly, although it must have been very swift in reality, blown by winds we could not feel, the tiny figure stepped from off the wing. As it fell, it looked as though it were unrolled on the end of a long white rope, which gradually bellied out to a huge umbrella shape.

I remember how I gasped and ran—ducking through the crowd, determined to see that figure hit the ground. When we came upon him he was stumbling grimly through the cornfield which surrounded the Fair Grounds. The white cloud, which had not yet collapsed completely, was jerking him along through the rows.

"Are you real, Mister?" I asked him respectfully with my panting first words. "My brother said you must be a dummy." I wonder still, at times, what he meant when he answered, hoarsely—"Sometimes I'm real, buddy, and sometimes I'm not."

Perhaps he referred to the feeling which many pilots have expressed, "That most 'chute jumpers get a little queer, after while." The idea seems to be that the whirling speed of descent—the frequently rough and jolting contact with earth and the mental strain of those last moments before the jump are quite likely to affect the strongest nerves in time.

Just after the jump. "Are you real mister or just a dummy?"

Real or not—"queer" or not—the parachute jumper is the last vestige of the old air circus still with us. On the last frontier of the old west—in strange modern contrast—we find the two survivals of two colorful enterprises.

In the heart of the cattle country—at the old-time rodeo an advertised parachute jump draws the crowds, and a barnstorming plane sedately takes passengers up and sets them down in a strictly genteel manner, while the bronco buster fans his mount and the steer-roping artist twirls his loop.

The air-minded viewpoint of a general public and the commercial success of aviation are not the sole reasons for this change. These are surface indications of the death of the winged horse and have much to do with progress and profits, but the real reason lies much deeper.

There is a deep inner difference in personal viewpoint. A flyer's life has ceased to be the wild career of adventurous danger in which they rode "hell for leather" and devil take the hindmost as did the young cow-punchers of the old west.

A story is told, whether true or not, of many of the famous stunt flyers, who carried wing-walkers in the air circus. Johnny—the name will do as well as any other—had carried his wing-walker many times and thought nothing of it—or if he thought, said nothing. Then one day the rope broke and the pilot in his plane slowly circled the descending figure of the unfortunate stunt man. "Never again—" said John-

XUM

ny. "No more wing-walkers for me."

Most flyers also dislike to carry a 'chute jumper, unless they have worked with him before and the flyer knows the jumper is careful and a good judge of wind. A parachute jumper who is careless in clearing the plane can so easily cause trouble both to the flyer and to himself. Sometimes the 'chute is caught on the plane and ripped. Sometimes the jumper damages a wing or a strut in his dive.

One pilot at an airport dedication in Texas had a serious accident which caused him not only a lasting horror of 'chute jumpers, but considerable unpleasant publicity and expense as well. In "bailing out" the jumper pulled his rip-cord too soon and fouled the silk on the rudder. The unfortunate parachute man was caught and held on the rudder, so that the pilot had either to shake him loose or carry him down with the danger of dragging him.

Such accidents are bad, not only for the victim but also for the reputation of aeronautics, and there lies the basic reason for the change in flying and flyers. Of the older group, those who are still flying are conservative, careful business-like pilots who feel their first duty is promotion of safety. The younger men who fly are educated and trained in this conservative theme—or they do not fly.

The reckless devil-may-care is not welcomed as a pilot—the army and navy frown upon him and commercial aviation excludes him completely. Recklessness carries too many chances for danger to others between the joy stick and the rudder bars and carelessness is too expensive to leave any margin for profit in a commercial plane.

The transition has been gradual, however, and there are still stunt flyers and exhibition stunts, as there are still ranches with much of the old-time glamor. Many war flyers drifted into circus flying and on into the air races and barnstorming tours, just as the rope artist and bronco busters have drifted from cold winter ranges into the movie lot and dude ranching, and on up to the rodeo and Madison Square Garden.

There is a poetic justice in the joining of their paths, for both have the same temperamental similarities, adventurous love of excitement—a quiet appreciation for true daring—and an insurmountable initiative in times of stress.

During our days of prosperity, Government administration policy included a program to interest the public in flying. Newly-built airports were dedicated by National Guard Air Squadron shows. Army and navy good-will tours with bombing planes and new detachments of special distinction were sent around after the old way of the air circuses. These touring squadrons gave many of the intricate stunt flights and formation drills of the air circus days.

One of these western air field dedi-

(Concluded on page 128)

The Giant "Clipper Ship" Now on Test

Front elevation of the Martin Clipper Ship showing its clean lines and the disposition of the four engines. The elevator is larger than the main planes of many ships.

THE Glenn L. Martin Company has completed one of the largest, if not the largest, flying boats in the world. This is the new "Clipper Ship" designed for the Pan-American Airways system, which has been in the process of construction for many months.

This giant among flying boats is a monoplane having four engines faired into the leading edge of the wing. It accommodates 50 passengers together with a heavy freight load, which puts it into the class of the Russian giant, the "Maxim Gorki." With four Pratt & Whitney engines, developing approximately 800 h.p. each, the craft is said to maintain a cruising speed of 180 m.p.h. and has a range of 3,000 miles. Full specifications and performance data are not yet available.

One noticeable feature is the simplicity of the exterior structure and the location of the struts, which run from the hull to the two outer engines, thus assuming these engine loads and relieving the wing structure from the greater part of the engine burden. The two inboard engines are comparatively close to the center connections so that they introduce a comparatively small bending moment into the wing structure, due to the weight of the engines.

The boat is virtually a parasol-type monoplane because of its elevation above the body, although the mid-wing flippers suggest the sesqui-plane class. The hull is a well-appearing job of at least, a close approach to streamline design, and the pilots' compartment is well faired into the assembly so that the parasitic resistance should be exceedingly low.

It is said that take-offs and landings are made easily and safely in very rough water.

Here is the Clipper Ship on its test flight, a view which shows many of the hull details and the tail-group.

High-Lights and Side-Lights

by M. A. RODDY

Notes and briefs on the aviation industry and those who are engaged in this industry. Bright and chatty comments upon aviation and those who make it.

AIR NOTES: Well, the little birdie that is always whispering into your ear is talking again . . . No doubt in the air industry the little birdie is none other than the goose that laid the golden egg.

Now the story is that the Federal Aviation Commission has completed its new deal for the air industry and Chairman Clark Howell, 71-year-old Atlanta publisher, will write the policy for permanent airmail legislation and present same to President Roosevelt whom he told when appointed to the Federal Air Commission that what he DID NOT know about aviation would fill a book . . . Another member of the Commission is Jerome Hunsaker, former Vice President of the Goodyear Zeppelin Corporation . . . Wonder if that has anything to do with all the dirigible talk during the Board's study of the airmail situation?

During the closing executive sessions of the Board, Washington scribes said that the doors of the chamber in which the hearings were being held were pasted over with brown wrapping paper . . . Why?

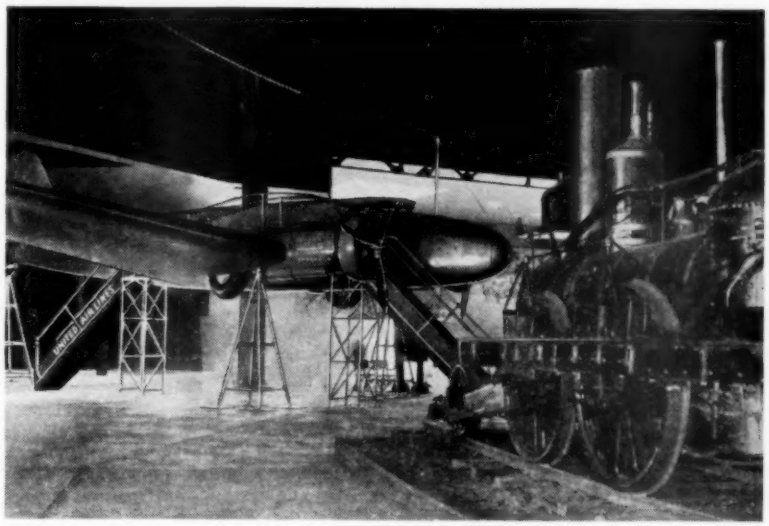
Maybe they were studying the replies to a circular letter which had been sent to aero clubs throughout the country asking that the present commission be made a permanent organization.

Lieut. Col. W. A. Bishop, distinguished war bird who accounted for 72 German planes while flying on the Western Front, has taken to the air again after twelve years on the ground. Recently he was taking FLYING INSTRUCTIONS to obtain a pilot's license at the Montreal Light Airplane Club Field. According to the Air Commerce Bureau, our own Eddie Rickenbacker has no pilot's license, nor has General William Mitchell . . . Must ask Elliott Roosevelt if he has a pilot's license.

ATTENTION KIWIS: Exhausted German swallows are being picked up by passenger planes and carried over the Alps to Milan so that they may continue their flight to the warm southlands . . . Sorta feathered hitch-hiking.

Our friend, Clyde Pangborn, who with Col. Roscoe Turner placed third in the London-to-Melbourne air race, is planning to start next summer an all-daylight non-stop round-the-world flight, refueling in mid-air . . . While Pangborn is taking a crack at Wiley Post's round-the-world record, Col. Turner will inaugurate a campaign to break all existing speed records, using an especially designed ship.

You might be interested to know that Sir MacPherson Robertson, multi-millionaire candy manufacturer of Australia, who posted the prize money for the Melbourne race, began his career 54 years ago in his mother's kitchen with a nail can for a stove and a five-cent tin pan . . . Recently he refused $25,000,000 for his business . . . Say, Mac, do you still have that old tin can?



Where the old and new meet. A Boeing transport plane and the ancient locomotive, "John Bull."

Word comes from Paris that a comfortable two-seater petting plane, radical in design but comfortable to the nth degree, has been designed and Tarzan McHale wants me to pass the word along to Walter Hunter of the famous Hunter Brothers, holders of the endurance record . . . It looks like a plot to get the most eligible of the airmail bachelors . . . However, it is not Leap Year so the hazard is reduced.

N. Pemberton Billings of London, former member of Parliament, announces that he has invented an airplane which can fly backwards . . . T. J. Traford Huteson, who in 1903 constructed an airplane in England which rose 36 feet off the ground, died in Seattle recently.

DISCOVERIES: Mr. Penguin, the bird with the boiled shirt who gives the low-down on all the arctic doings, wants it known that Admiral Richard Byrd, Chief Pilot Harold June, Co-pilot William Bowlin, Navigator Kennett L. Rawson, Radio Operator Clay Riley, and Cameraman Joseph A. Pelter have discovered a long-sought passageway through the icy sub-continent of Antarctica and have claimed the land for the United States . . . Sir Hubert Wilkins and Pilot Bernt Balchen have also flown over unknown arctic lands on their present exploration of the southern polar regions.

Dave Behncke and the airline pilots think that Mr. Vidal might add to the tribute to the Wright brothers if when the second celebration is held, the Wright ship be on exhibit in this country rather than in England where it is now on display as after all that is the only monument . . . Banquets are soon digested and speeches forgotten.

Jack Oates, former aerial gunnery instructor to Admiral Byrd, relates the story of a certain well-known airman full of repeal water who got into an argument, and in later apologizing to Police Captain John Prendergast of Chicago, said: "I guess I made a mistake when I hit that man." "No," corrected the Captain, "you made two mistakes. First, when you hit him and second he was a detective."

Quick Watson!!

Following up last month's exclusive tip that airmail operators are expecting drastic changes, it is reliably reported around Washington that Postmaster General Farley is due to step out of that office . . . W. W. Howes will step in . . . Already the operators have gained by the authorization of several new airmail schedules which is accepted as a move prior to the adjustment of the present low rates . . . Airline pilots scored a signal victory in the test case revolving around the cancellation of the Long and Harman airmail contract when the Post Office Department ordered the airmail contractors to abide by the provisions of the airmail law re-

(Concluded on page 121)

case in material like shot, or sand, or a fluid like water.

One revolution of the conveyor, then, will move this material back a distance (p) equal to the pitch of the screw. When the entire cylinder is filled with the material and the screw is kept turning, a certain pressure will be exerted on the end plate (h).

As soon as this pressure exceeds the weight (l), the screw, the shaft, and the cylinder (d) will move jointly forward in the direction of the arrow. The faster we turn the crank, the faster the cylinder will move forward. It is necessary, of course, that the material be fed in at a speed equalling that at which the material is displaced by the screw.

If the weight (l) should be made twice as heavy, it would, of course, require a force twice as great at the crank in order to move the cylinder forward at the same speed as before.

If the pitch of the screw were made half as great and the weight (l) were the same as it was originally, the crank would have to be turned twice as fast as before in order to move the cylinder forward at its original speed. The amount of material displaced would remain the same.

Now, instead of using an incompressible material, we introduce a material *amenable to compression and of such density that it will have to be compressed to half its volume in order to attain the same solidity and weight as the first material.*

Clearly, if the speed of the cylinder is to be the same as that with the incompressible material, twice the volume of the lighter material will have to be moved in order to overcome the resistance of the weight (l).

This can be accomplished by keeping the pitch of the screw the same as before and turning it twice as fast, while applying the same force at the crank. The compressible material will then have to be fed in at twice the speed of the incompressible material. It could also be done by turning the crank with the same force at the same speed as before, while using a screw having twice the pitch of the original one, the feeding in of the compressible material being again effected at twice the speed of the incompressible material.

Again, the same result could be obtained by keeping the pitch of the screw the same as it was originally, but increasing the diameter of the screw (and cylinder) so that the new disc area of the screw would be twice as large as the original area.

Several other variations and combinations could be made; the above cited examples are sufficient to show that a definite relationship exists between the power applied, the diameter of the screw, the pitch of the screw, the pressure exerted by the material, and the density of the material; it is obvious that a variation in any of these quantities will affect the final result.

(Continued on page 116)

The Aero-Sportswoman

by JOAN THOMAS

Ruth Kitchel Wakeman and her Fairchild cabin plane with which she performs many joy hops. She has had an extended flying experience and holds a transport pilot's license.

RUTH KITCHEL WAKEMAN, transport No. 18221, has the distinction, among other things, of being the first and only woman-member of the new Aviation Country Club of Chicago. She is, also, chairman of the Chicago chapter of the 99 Club and an active member of the W.N.A.A.

Unfortunately for the A.C.C. and the rest of us here, who are interested in aviation, business connections are taking the Wakemans to San Francisco for the coming year. We are sorry to lose them in the Chicago territory, but are happy to know that it is only to be for a short time.

After graduating from the University of Michigan in 1929, Ruth worked for two years on her mother's newspaper in Coldwater, Michigan. It was during this time that she learned to fly and purchased a Warner-powered Travel-Air. She was able to combine her flying and journalism in various ways, by distributing special editions of the paper and scattering hand-bills over various nearby towns.

As an advertising feature she instigated a special "Airplane Edition" and distributed prize copies from her ship. "The prizes were all collected," she said, "but it didn't produce any startling increase in the circulation."

After she received her transport license, she tried her hand as a saleswoman for the Curtiss-Wright Corporation. Unfortunately, before she had had much experience in that line the Detroit base was discontinued.

"Most of my flying since then," she said, "has been purely for pleasure and the only remuneration has been lots and lots of fun! I have made a number of interesting flights including trips to Wichita, Kan.; Kingston, Canada; Baton Rouge, La.; Washington, D. C.; New York City; and have participated in two Michigan Air Tours.

"I had a rather amusing experience on my trip to Canada. I didn't know that anyone would keep track of me, and so after starting for Kingston, I decided to stop in Toronto. Mistaking the Army Field for the Municipal Airport, I landed and when I found that they were having an air-meet, it never occurred to me that it would make any difference, so stayed and watched the show for a couple of hours before going on.

"When I arrived in Kingston, I went over to the hangar to arrange for storing the ship and transportation into town. There seemed to be something wrong, one of the pilots dashed in, yanked open a locker and pulled out his helmet and goggles — mumbling something about 'these darn women-flyers that get lost.'

"When I interrupted his hurried preparations, to inquire for the field manager, it transpired that I was the 'lost flyer!' My departure and expected time of arrival had been reported by teletype and when I was, apparently, two hours overdue and unreported at any of the regular airports, they had begun to organize a searching party."

Mrs. Wakeman not only kept up her own flying interests after she got married, but has succeeded in getting her husband thoroughly enthused about it. At first he was not interested, although he did not oppose Ruth's flying. He was perfectly willing to go along in the front cockpit as a passenger for the first year or so, but this last summer he started to take instruction and is just beginning to realize what he has been missing! And when Jill, the young daughter, reached the air-minded age of six months or so, the Wakemans decided the open Travel-Air was not a suitable ship for the young lady and have purchased a shiny, new Fairchild-24.

(Concluded on page 120)

The World's First Airmail

by LIEUT. H. LATANE LEWIS, II

More than 150 years ago, a balloon carrying paid mail matter, sailed over the English Channel. And while the flight took place in Europe, yet it was American money that provided the balloon and an American physician who went along as a passenger.

THE world's first airmail came fluttering down from a balloon over France 150 years ago. While the flight took place in Europe, it was paid for with good American gold and a Yankee physician went along as co-pilot.

One clear, crisp morning in January, 1785, a strange object, the like of which had never before been seen in England, was tugging at her mooring line on the chalk cliffs of Dover. Jean Blanchard, a Frenchman and one of the first men in the world to venture into the air, was bustling about, assisted by Dr. John Jeffries of Boston. The balloon belonged to Jeffries and he had hired Blanchard to fly him across the English Channel.

At the last moment, the wily Frenchman, who wanted the glory of the flight all for himself, refused to take Jeffries along, declaring the balloon would not lift the additional weight. However, the Yank physician, with typical shrewdness, began to divest Blanchard of some of his multitudinous garments and found that he had secreted a large number of lead weights in them. Even then, it was only by agreeing to jump into the sea if necessary that Jeffries was permitted to go along in his own balloon.

About 1 o'clock, the airship rose slowly and majestically over the cliffs and began to drift off lazily toward the east. The countryside was covered with crowds of people who had come to see the first balloon to make a sea-going flight.

Only 30 pounds of ballast was carried. The other objects in the car were a large parcel of pamphlets, two cork life preservers, a few extra clothes for M. Blanchard, a number of inflated bladders, two small anchors, and the packet of letters. The passenger car was fitted with oars to enable the aeronauts to row themselves through the air.

"At quarter past 1 o'clock, we appeared to have risen considerably but yet to have made very little progress and that to the eastward," states Dr. Jeffries in his account of the voyage, which was printed in London the year following. "We passed over several vessels of different kinds, which saluted us with their colors, as we passed them; and we began to have an extensive view of the coast of France. At 50 minutes after 1, I found we were descending fast. We appeared at that time to be about one-third of the way from the English to the French coast."

The choppy waters of the channel were coming towards them rapidly. Jeffries lost no time in dropping overboard a ten-pound bag of sand and the balloon shot upward like an elevator. However, a few miles further on, when they were right in the middle of the channel, the temperamental craft once more plunged downward. This time all of the remaining ballast had to be jettisoned and other objects had to be dropped as well to keep the airmen from getting a ducking.

The first airmail leaving the cliffs of Dover, England, bound for France. From an old English woodcut issued more than 100 years ago.

The big bag rose laboriously and they breathed a sigh of relief. But the flight was not yet over and soon again the fickle airship began to drop at high speed. The lower part of the balloon had collapsed so that the bag was not three-fourths inflated.

"We immediately threw out all the little things we had with us, such as biscuits, apples, etc.," states Jeffries, "and after that, one of our oars, or wings; but, still descending, we cast away the other wing, and then the governail. Then," the doctor adds ruefully, "we cast away the only bottle (of brandy) we had taken with us, which in its descent seemed to force out a considerable steam like a smoke with a hissing or rushing noise and when it struck the water we heard and felt the shock very perceptibly on our car and balloon. As we did not yet ascend, we were obliged, though very unwillingly, to throw away our anchors and cords, but still approaching the sea, we began to *strip ourselves*."

Blanchard's voluminous coats went fluttering into the sea, followed that of Jeffries'. Trousers, too, were tossed to the winds and then all outer garments were shed. Still the craft dropped toward the angry sea. It began to look as if Jeffries would have to make good his promise to jump.

"We then put on our cork-jackets and prepared for the event," he states. They climbed up into the rigging and made ready to cut loose the car. Then Jeffries had an idea. Both men had eaten hearty meals before shoving off, and Jeffries proposed that they get rid of this weight by vomiting.

However, they were spared this undignified performance, for just at that time, states the doctor, "I found the mercury in the barometer again falling, and looking around, soon observed that we were rising and that the pleasing view of France was opening before us every minute."

Slowly they drifted across the checkerboard fields and streams of France. Near Calais the first delivery of airmail was made. "A packet of letters, cast out by M. Blanchard, was several minutes in reaching the earth and afforded an amusing scene to us in observing it during its descent; it appearing in its progress to pass along over inclosures, houses, roads, etc., as if running after us; and finally settled in a field in a straight line perpendicular to us."

While this method of delivery may seem somewhat crude to the sophisticated reader of today, yet contains the germ of an idea in mail delivery that is being experimented with today, and it is therefore just possible that in years to come, airmail will be dropped off in a somewhat similar but less abrupt manner than that just described.

But when the stage of balloon development of that day is considered it was quite a remarkable flight that was brought to a close without accident and with fair precision as to course and direction.

As the balloon skimmed low over the forest of Guines, Jeffries reached out and grabbed a branch of a tree and pulled the balloon to rest on the tree-tops.

Thus ended the first airmail flight and the first flight ever made by man over the sea. Blanchard was awarded a large sum of money by Louis XVI of France and given a yearly pension. Jeffries returned to Boston where he practiced medicine for the next 30 years.

END

The International Aircraft Code

BY INTERNATIONAL agreement, each nation is assigned certain letters for the identification of their aircraft. By observing these symbols upon the sides of the planes, it is possible to quickly determine the nationality of the plane.

Planes owned by citizens of the United States, for example, are indicated by a first letter (N) and a second letter which ranges from (A) to (Z). Thus, a U.S. plane may bear a prefix such as NA, NC, NK, NU, etc., followed by four figures or letters, thus: NC-2345, NU-8888, etc. Sweden has been given a prefix of SE, Italy of I, and so on, through all of the nations. The numbers following the identifying letters are for the purpose of serially listing individual planes under prefix.

These letters and figures are known as "registration numbers" and are compulsory according to both national and international law. They are particularly necessary when flying over foreign soil, or overseas. This information will be of great value to students and model builders who may wish to ascribe or determine the national markings on a plane.

A followed by numbers			AUSTRIA
CC-AAA	to	CC-ZZZ	CHILE
CF-AAA	to	CF-ZZZ	CANADA
CH- followed by nos.			SWITZERLAND
CL-AAA	to	CM-ZZZ	CUBA
CN-AAA	to	CN-ZZZ	MOROCCO
CP-AAA	to	CP-ZZZ	BOLIVIA
CR-AAA	to	CR-ZZZ	PORTUGESE COLONIES
CS-AAA	to	CS-ZZZ	PORTUGAL
CX-AAA	to	CX-ZZZ	URUGUAY
CZ-AAA	to	CZ-ZZZ	MONACO
D-AAAA	to	D-ZZZZ or D followed by numbers	GERMANY
EC-AAA	to	EC-ZZZ	SPAIN
EI-AAA	to	EI-ZZZ	IRISH FREE STATE
EL-AAA	to	EL-ZZZ	LIBERIA (Republic of)
ES-AAA	to	ES-ZZZ	ESTONIA
ET-AAA	to	ET-ZZZ	ETHIOPIA
EZ-AAA	to	EZ-ZZZ	TERRITORY OF THE SAAR
F-AAAA	to	F-ZZZZ	FRANCE (Colonies and Protectorates)
G-AAAA	to	G-ZZZZ	GREAT BRITAIN
HA-AAA	to	HA-ZZZ	HUNGARY
HC-AAA	to	HC-ZZZ	ECUADOR
HH-AAA	to	HH-ZZZ	HAITI (Republic of)
HI-AAA	to	HI-ZZZ	DOMINICA (Republic of)
HJ-AAA	to	HK-ZZZ	COLUMBIA (Republic of)
HR-AAA	to	HR-ZZZ	HONDURAS (Republic of)
HS-AAA	to	HS-ZZZ	SIAM
I-AAAA	to	I-ZZZZ	ITALY and Colonies
J-AAAA	to	J-ZZZZ	JAPAN
LN-AAA	to	LN-ZZZ	NORWAY
(Except combinations containing A - AE - O)			
LZ-AAA	to	LZ-ZZZ	BULGARIA
NA-AAA	to	NZ-ZZZ	UNITED STATES OF AMERICA
OB-AAA	to	OB-ZZZ	PERU
OH-AAA	to	OH-ZZZ	FINLAND
OK-AAA	to	OK-ZZZ	CZECHOSLOVAKIA
OO-AAA	to	OO-ZZZ	BELGIUM and Colonies
OY-AAA	to	OY-ZZZ	DENMARK
PH-AAA	to	PH-ZZZ	HOLLAND
PJ-AAA	to	PJ-ZZZ	CURACAO
PK-AAA	to	PK-ZZZ	NETHERLANDS INDIA
PP-AAA	to	PP-ZZZ	BRAZIL
PZ-AAA	to	PZ-ZZZ	SURINAM
R followed by 3 figures			ARGENTINE (Republic of)
RA-AAA	to	RQ-ZZZ	UNION OF SOVIET SOCIALIST REPUBLICS
RV-AAA	to	RV-ZZZ	PERSIA
RX-AAA	to	RX-ZZZ	PANAMA (Republic of)
RY-AAA	to	RY-ZZZ	LITHUANIA
SE-AAA	to	SE-ZZZ	SWEDEN
SP-AAA	to	SP-ZZZ	POLAND
SU-AAA	to	SU-ZZZ	EGYPT
SX-AAA	to	SX-ZZZ	GREECE
TC-AAA	to	TC-ZZZ	TURKEY
TF-AAA	to	TF-ZZZ	ICELAND
TG-AAA	to	TG-ZZZ	GUATEMALA
TI-AAA	to	TI-ZZZ	COSTA RICA
UH-AAA	to	UH-ZZZ	HEDJAZ
UL-AAA	to	UL-ZZZ	LUXEMBOURG
VH-AAA	to	VH-ZZZ	AUSTRALIA
VO-AAA	to	VO-ZZZ	NEWFOUNDLAND
VP-AAA	to	VP-AZZ	GOLD COAST (including Ashanti, Northern territories of the Gold Coast and British Togoland)
VP-BAA	to	VP-BZZ	BAHAMAS
VP-CAA	to	VP-CZZ	CEYLON
VP-FAA	to	VP-FZZ	FALKLAND ISLANDS and their Dependencies
VP-GAA	to	VP-GZZ	GUIANA (BRITISH)
VP-HAA	to	VP-HZZ	HONDURAS (BRITISH)
VP-JAA	to	VP-JZZ	JAMAICA and its Dependencies
VP-KAA	to	VP-KZZ	KENYA (Colony and Protectorate of)
VP-LAA	to	VP-LZZ	LEEWARD ISLANDS
VP-MAA	to	VP-MZZ	MALTA
VP-NAA	to	VP-NZZ	NYASALAND PROTECTORATE
VP-PAA	to	VP-PZZ	ISLANDS OF THE WESTERN PACIFIC HIGH COMMISSION
VP-RAA	to	VP-RZZ	NORTHERN RHODESIA
VP-SAA	to	VP-SZZ	SOMALILAND PROTECTORATE
VP-TAA	to	VP-TZZ	TRINIDAD AND TOBAGO
VP-UAA	to	VP-UZZ	UGANDA PROTECTORATE
VP-VAA	to	VP-VZZ	ST. VINCENT
VP-WAA	to	VP-WZZ	WEIHEIWEI
VP-XAA	to	VP-XZZ	GAMBIA (Colony and Protectorate of the)
VP-YAA	to	VP-YZZ	SOUTHERN RHODESIA
VP-ZAA	to	VP-ZZZ	ZANZIBAR PROTECTORATE
VQ-BAA	to	VQ-BZZ	BARBADOS
VQ-CAA	to	VQ-CZZ	CYPRUS
VQ-FAA	to	VQ-FZZ	FIJI
VQ-GAA	to	VQ-GZZ	GRENADA
VQ-HAA	to	VQ-HZZ	ST. HELENA
VQ-LAA	to	VQ-LZZ	ST. LUCIA
VQ-MAA	to	VQ-MZZ	MAURITIUS
VQ-PAA	to	VQ-PZZ	PALESTINE
VQ-SAA	to	VQ-SZZ	SEYCHELLES
VR-BAA	to	VR-BZZ	BERMUDA
VR-GAA	to	VR-GZZ	GIBRALTAR
VR-HAA	to	VR-HZZ	HONGKONG
VR-JAA	to	VR-JZZ	JOHORE (State of)
VR-LAA	to	VR-LZZ	SIERRA LEONE (Colony and Protectorate of)
VR-NAA	to	VR-NZZ	NIGERIA (Colony and Protectorate of) (including the British Cameroons)
VR-RAA	to	VR-RZZ	FEDERATED MALAY STATES
VR-SAA	to	VR-SZZ	STRAITS SETTLEMENTS
VR-TAA	to	VR-TZZ	TANGANYIKA TERRITORY
VR-UAA	to	VR-UZZ	BRUNEI (State of)
VT-AAA	to	VT-ZZZ	BRITISH INDIA
XA-AAA	to	XB-ZZZ	MEXICO
XT-AAA	to	XT-ZZZ	CHINA
YA-AAA	to	YA-ZZZ	AFGHANISTAN
YI-AAA	to	YI-ZZZ	IRAQ
YJ-AAA	to	YJ-ZZZ	NEW HEBRIDES
YL-AAA	to	YL-ZZZ	LATVIA
YM-AAA	to	YM-ZZZ	DANZIG
YN-AAA	to	YN-ZZZ	NICARAGUA
YR-AAA	to	YR-ZZZ	RUMANIA
YS-AAA	to	YS-ZZZ	SALVADOR (Republic of)
YU-AAA	to	YU-ZZZ	YUGOSLAVIA
YV-AAA	to	YV-ZZZ	VENEZUELA
ZA-AAA	to	ZA-ZZZ	ALBANIA
ZK-AAA	to	ZM-ZZZ	NEW ZEALAND
ZP-AAA	to	ZP-ZZZ	PARAGUAY
ZS-AAA	to	ZS-ZZZ	SOUTH AFRICA (Union of)

It should be noted that in allocating registration lettering for aircraft, the following three-letter groups should be omitted in order to avoid confusion with existing W/T abbreviations.

(1) All combinations commencing with the letter Q.
(2) S.O.S.
(3) P.A.N.
(4) T.T.T.
(5) X.X.X.
(6) A.B.V., A.D.R., C.F.M., C.O.L., I.T.P., M.S.G., P.B.L., P.R.B., R.E.F., R.P.T., S.I.G., S.V.C., T.F.C., T.X.T.

A Novel Navy Game

EVEN the hard-boiled navy flyers, those keen-eyed tanned young lieutenants who man the speedy bombers of the U.S.S. aircraft carrier, Saratoga, must have their little fun mixed in with the serious business of flying.

During the cruise on the home stretch from Guantanamo—where the squadron has been carrying on maneuvers with the fleet—to California, everyone felt the need of a bit of relaxation. The termination of hot weather and long working hours aboard ship was near, and spirits were at concert pitch.

The men of Squadron Two-B finally organized a game which they describe thus:

"If a flyer makes a mistake of any kind he is given a washer. The mistake may be something he has forgotten to do, or it may be the result of his clumsiness. If his engine does not start the first time it is cranked, this comes under the classification and he receives a washer. Any observing mechanic working on the plane is entitled to award the washer.

"If a man spills paint while working on his plane, he is sure to be handed a washer. In making these and other mistakes, some of us collected a considerable number of washers.

"It is naturally not very complimentary to have for a hobby this particular type of collection, and a resultant alertness throughout the squadron is the result of the game.

"The origin of the pastime is an interesting one. It has been traced to a new man in the squadron, who was known to have but slight previous acquaintance with aviation engines. His engine failed to start twice in succession after heroic attempts.

"'Drop a nickel in the slot,' someone suggested, and he obligingly slipped a washer into the fuse box and began cranking away. As might be expected, the unexpected happened, and the engine started right away."

Welch in New Home

THE ORRIN WELCH School of Aviation, Anderson, Ind., is now operating from their new airport which they have acquired recently. Hangars have been constructed, and by spring, the Welch companies expect to have a sufficient number of buildings erected on the field to accommodate manufacturing of both their popular priced airplane and motor which they have recently placed on the market.

During the winter, most of these operations will be carried on in buildings which they have leased in the City of Anderson. The factory is now busy completing five ships which have recently been ordered and are enjoying a remarkable response from the announcement of their popular priced plane.

The Importance of Check-Ups

by MAX KARANT

A review of the recent Bureau of Air Commerce suggestions on the maintenance of privately owned airplanes. It is mighty good advice and interesting reading.

WHETHER you own or operate an airplane or are just a "shipless pilot" you had better read this article a little more carefully than usual as it is of vital importance to you. The latter statement should be taken both literally and figuratively.

For the past several months the engineering section of the U.S. Bureau of Air Commerce has been making a detailed and thorough study of the care and maintenance of privately-owned aircraft—or, shall we say, the lack of it. Statistics gathered by the bureau show that a surprising percentage of accidents involving privately-owned aircraft could easily have been avoided had the owners of the machines been a little more thorough and careful in the inspection and maintenance of their craft.

A somewhat detailed report, accompanied by recommendations for the correction of the faulty conditions found, has recently been completed by the Air Commerce Bureau and the most important bits of advice to the sportsman pilot and owner are included in the following paragraphs. Note them carefully and act accordingly. There is usually more fabric on the average airplane than anything else and it is this covering that probably receives the least attention. Even though your linen is of the best grade money can buy and is supposedly well protected with good pigmented dope, it will inevitably deteriorate—depending, of course, on the amount of exposure to the elements to which it is subjected.

In checking up the connections, don't overlook the landing-gear members. Even though they do not assist in flying, they are indispensable in landing and require frequent attention for safety.

The government engineers point out, however, that fabric deterioration is indirectly an advantage as the removal of the old covering affords an excellent opportunity for close inspection of the interior structure of the fuselage, wings and tail assembly. While we are still on the subject of fabric, you are further warned that, if you allow your airplane's covering to get too old, you are liable to take your ship up on a bumpy day and suddenly find yourself without a normally-covered wing. In fact, even something as tame as a power circle or an inside loop might leave you up there with an airplane that is but a mere skeleton of its former self.

Another portion of the privately-owned airplane that is commonly neglected is the control cable system. You would be surprised how much wear cables receive as they pass through fair-leads or over pulleys. To be on the safest side, you should inspect, clean and grease these wires periodically. If your ship lacks several of those conveniently-placed inspection flaps with the zippers, it will be well worth your while to have as many installed as is necessary.

Another point many private flyers neglect until they have been given the scare of their lives is the presence of slack control cables. Loose cables give your control surfaces the best excuse in the world to set up as much flutter as is necessary to shake your ship to pieces in the air. There have been altogether too many good pilots buried merely because they lost an aileron or elevator in mid-air.

If there are any wooden joints or a wooden prop on your ship you simply *can't* give them too much attention! Practically all of the wood in an airplane is held together by glue and glue is a very temperamental substance.

Of course, water is its worst enemy and your machine should be kept as free of moisture as possible. Both the joints and prop should be kept covered with good, clear varnish. *Don't* use pigmented paint on your propeller as it covers up or fills in splits and checks and hides crushed portions that sometimes appear around bolt holes in the hub.

In the case of the metal prop, never fly your ship if its metal prop has any sharp nicks in its blades. You can take the aeronautical engineer's word for it that it is of the utmost importance that you carefully safety and round out these nicks and also etch the base of each nick to see whether or not a fatigue crack has started. Fatigue cracks have been responsible for many pilots finding themselves up in the air minus one or both propeller blades. And, if these boys aren't fast enough on the switch, they are sure to be left without an engine and confronted wth the task of safely landing a very, very tail-heavy airplane.

Everyone knows that one of the worst enemies of any metal is corrosion. Aircraft duralumin is no exception to the rule. Besides periodically checking all metal on your ship you should keep every part perfectly cleaned and refinished.

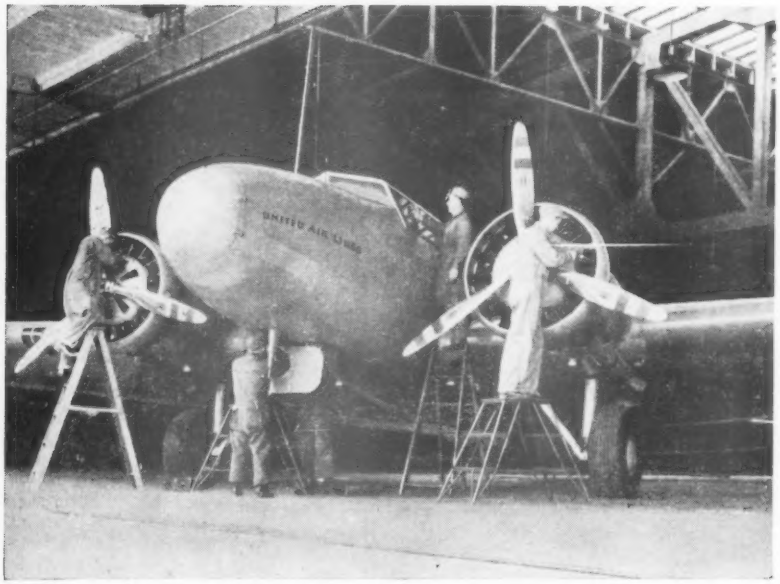
A good way to prevent corrosion in airplane tubing is to pour hot oil *inside* the tubing and allow the surplus to drain out. The tube walls will retain a film of oil that is sufficient for the purpose. Hundreds of forced landings are due to faulty or dirty fuel systems. There is only one answer to that problem—keep your fuel screen clean at all times and flush out all tanks and lines regularly.

There have been occasional cases of bolts or cotter pins shaking loose be-

(Concluded on page 127)

The Operations Department

by
E. STANTON BROWN
Commercial airways editor for
POPULAR AVIATION.



Here the ground crew is making the final inspections and adjustments on a United Air Lines plane just before it leaves on its scheduled flight. Every little detail is carefully checked and re-checked before the ship leaves the ground.

TRIP 5 roared westward through the last hour of night. The struggling dawn was stifled in a blackly ominous blanket of surly Nimbus clouds. A light snow was greedily sucked into the slashing jaws of whirling propellers and whirled back into the churning turbulent slipstream.

Pilot Denby peered through the windshield at dimly flashing airway beacons. Through his headphones came the steady reassuring hum of the radio beacon. His eyes turned to the instrument board and roved swiftly over the quivering needles. With sure hands and feet he jockeyed the hurtling ship as sharp gusts battered it.

The Mate switched on his transmitter.

"United Air Lines plane 309, 15 miles east of Omaha," he reported tersely.

"O.K. 309," an answering voice crackled in the earphones. "Come in. Ceiling 800 feet. Wind 20 to 25 miles east. Passengers will be entrained."

The Mate pressed a button. An instant later the stewardess looked inquiringly into the pilots' cabin.

"Passengers to be entrained at Omaha," she was informed.

With a nod and a smile she closed the door and went about her duty of passing the information on to the passengers.

Eight minutes later, the Boeing 247 lightly settled on the Omaha Municipal Airport, set amidst gently rolling hills, and taxied swiftly to the passenger station. The passengers scurried into its warm interior to a well-cooked breakfast.

One of them stopped short within the door.

"I want to see the pilot," he demanded in a harsh voice.

"Yes, sir?" inquired that individual.

"Why aren't we going through?"

"Weather's very bad, sir, and getting worse."

"Now listen," grated the passenger, "don't hand me that line. I've got to be in San Francisco tonight, see!"

"I'm sorry," courteously answered the pilot. "If there was a possibility of our getting safely through, we'd do it. As it is, the weather is O.K. west of North Platte. There will be a plane waiting for you there."

"Rot!" exploded the passenger. "I'm not going to be pushed around like this. I want service. I paid for it. I . . ."

"The pilot's right," quietly cut in the voice of another passenger.

"Yeah? What do you know about it?"

"I know," said the other man eyeing him coldly, "that if it were *safe* to go through, we'd go through. I know that no business is as important as human lives. I appreciate the service the line is rendering me in guarding my life so well."

Service! The Operations Department of any airline is built on and around that word. After the Traffic Department has secured the passenger and sold him a ticket, it is up to Operations to deliver the goods; to swiftly, safely, comfortably and courteously deliver the passenger to his destination.

Last month, the writer pointed out the effect that equipment has on influencing the flow of passenger traffic from one line to another over competi-

Air-express is one of the most important and rapidly developing branches of commercial air transportation. Here, the attendants are loading express packages on a General Air Lines plane.

Keeps 'em Flying on Time

tive routes. If, however, excellence of equipment is not supplemented by *service*, and personal service to the passenger, the advantage of superior equipment is considerably nullified.

The major lines in the country have developed their service to a high degree, some to a greater extent than others. In the mechanical departments, communications, mail traffic and in the general excellence of pilot personnel, most lines are very much the same. It is in the more personal services of stewardesses and passenger inspectors or the lack thereof, that the passenger is impressed.

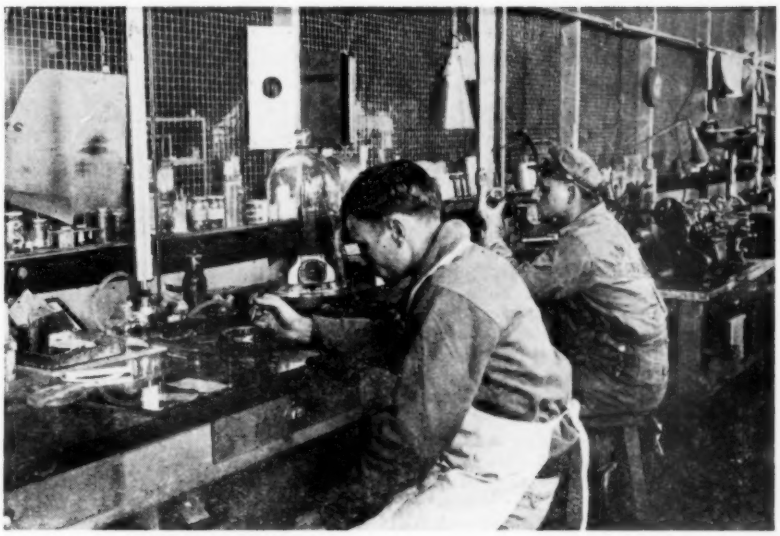
E. P. Lott, Operations Manager for United Air Lines, stated enthusiastically to the writer that the stewardess was the best salesman on the line when it came to keeping passengers flying again and again on United. Right he is. The efficient and courteous girls contribute the final touch in personal service to meet the demands of the most exacting traveler. The additional expense is more than justified.

It is amazing, that on only two lines in the United States do we find stewardesses—on United Air Lines and on American Airlines. United is the only line having them on all ships, since American does not use them on flights on which meals do not have to be served.

They are particularly valuable for the psychological effect produced upon first-flighters. When it is seen that a woman is a member of the crew of an airliner, new passengers and even old-timers, have a greater feeling of security and faith in the ship. The calm, smiling, matter-of-fact manner of the stewardess does much to allay first qualms.

When they are over, her pointing out of interesting places on the route, her cheerful answering of questions, the serving of meals, all does much to make the trip enjoyable. The knowledge that she is always there to supply a magazine or to assist in case of illness still further adds to the sense of comfort and security.

Supplementing the personal service of stewardesses, is that of passenger inspectors. Their duty is to see that all linen, seat-covers, pillows, etc., are clean and in good condition. They make sure that the prepared lunches are just what they should be and attend to numerous other details having to do with the general cleanliness and fitness of cabin equipment.



A glimpse at a branch of the mechanical service department—the instrument repair shop. Here the various delicate and watch-like instruments are tested and corrected for error.

A radio ground station with the transmitter panels at the right. This department keeps in constant contact with the pilots, records their positions and keeps them informed on various matters concerned with traffic.

It may seem a bit paradoxical that, in speaking of the Operations Department, one should choose to speak first and at such length about the personal service rendered passengers in the cabin. Operations usually suggests hangars, torn down engines, planes undergoing servicing and repair, the smell of gas and oil and flying. Right, but this side of the picture, which was all of aviation before the advent of airlines, now has as its goal, service to the passenger.

The mechanical side of the picture is becoming more routine every day. Methods are becoming standardized. Planes, on landing, are checked and serviced. Minor troubles are corrected. Sparkplugs, fuel-pump, ignition, lights, controls are given a cursory but thorough examination. The ship is fueled and motors tested before each flight.

Every forty and eighty hours the ships are given a more thorough and complete inspection. At the end of 350 hours in the air they are hauled into the central repair base for a general overhaul of engines and plane. Such repair bases are usually located at a central point on the line. United's is at Cheyenne, American's at Chicago and TWA's at Kansas City. The bases are equipped to do anything to an airplane, even to completely rebuilding it if necessary. The methods, equipment and other details pertaining to repair bases will be dealt with in a later article.

The importance of the mechanical department cannot be overemphasized. Upon it rests the responsibility of keeping the ships in the air, efficiently and safely operating. The low percentage

of forced landings due to mechanical trouble speaks eloquently of the high standards maintained by the personnel.

When a passenger waiting in the station hears blasting through the public address system, "United Air Lines, trip 18, 8:30 plane leaving for Toledo, Cleveland, Kylertown, Philadelphia and New York at gate 3," he would be amazed if he could view at a glance the infinite number of details, each carefully attended to by a specialist, before that announcement can be made.

We have already briefly scanned the mechanical handling of the ship and know that a passenger inspector has O.K.'d it as presentable for occupancy.

Before the ship can leave, the company meteorologist must have taken all lastest available data on weather conditions over the route to be traversed, and compiled it into useable and quickly understandable form for the pilot. This is passed on to the dispatcher.

If the weather is such as to show the probability of the ship being forced down at an intermediate field before a regular scheduled stop can be made, the trip is cancelled. If, however, the weather is O.K., for example, as far as Cleveland but doubtful or rotten beyond that point, the passengers are notified from one to two hours before plane time, as is also the case with a cancellation. They then have their choice of cancelling their reservations or of going as far as the weather permits.

Every effort is made to fly the passengers as far as possible and practical. Continuance or discontinuance of a flight lies with the pilot and the dispatcher. A double check is maintained by giving the dispatcher power to keep the pilot on the ground in case he should elect to take-off in the face of doubtful conditions, but the dispatcher cannot make the pilot go out if he does not want to.

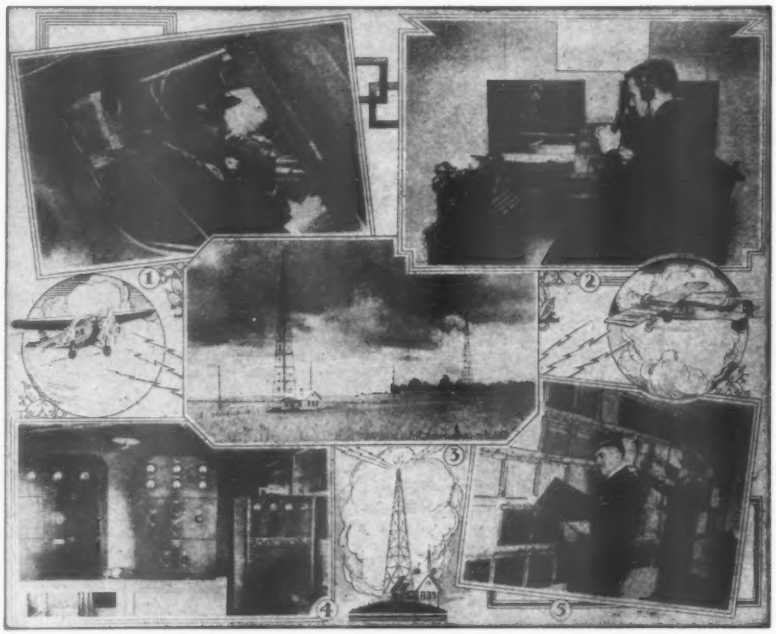
While the pilot and dispatcher have been checking the weather, the mail traffic department has attended to the dispatching and loading of mail. Express is loaded into its compartment. The ship then takes on its passenger load.

As the door closes behind the passengers, the stewardess sees that seat belts are fastened for the take-off and presents each passenger with a newspaper and an envelope containing cotton and chewing gum for use by those whose ears are troubled by altitude.

In the meantime, the field traffic manager in the airport radio control tower has contacted the ship. Briefly he gives the pilot wind direction and velocity and informs him of the positions of other ships in the air. The plane then taxies to the end of the runway to be used for the take-off.

Perhaps it is held a moment or two while another plane comes in. After it has landed, a green light shows on the airport radio control tower indicating that the ship may take off.

First one motor and then the other is opened up for a last minute's testing. With brakes locked, both motors



Radio on the American Air Lines system. Pilots in flight and ground systems are in constant contact, checking all conditions of flight. (1) Pilot reporting his position. (2) Operator in ground station contacting a plane in flight. (3) Bureau of Air Commerce airway radio station. (4) Operating room with new transmitter with automatic tuning control. (5) Weather report room where nation-wide reports are posted.

are then opened up—the brakes are released—the ship rolls forward—the tail is up—she's off.

As soon as the ship clears the field, the company's communications department swings into action. The ship is contacted and any first minute information given it. Perhaps a radio has just been received that a passenger is to be picked up at a flag stop.

Throughout the flight the communications department maintains contact with the ship. Every thirty minutes the pilot reports his position and receives weather reports. If the ship is buffeted by headwinds strong enough to delay its arrival, the pilot so reports

The services of the stewardess have much to do with keeping passengers "sold" on an airline.

and such information is posted on an arrival and departure board.

Word is flashed down the line that the ship, together with its number, crew and passengers list, has just taken off on such-and-such a trip bound for such-and-such a destination. When the ship reaches its destination, word is radioed back to its point of departure of its safe arrival and time of arrival.

The communications department, of course, handles all dispatches for the company. Through it space for the traffic department is requested and released along the route.

Still other departments go to make up Operations. In the instrument section there is a crew of instrument specialists whose duty it is to keep all instruments functioning properly.

The instrument laboratory is fitted with complete equipment for the testing and repair of every instrument in the ship. After an instrument has been reinstalled, an instrument man goes up on a test hop to check its functioning in the air.

In the regulations department it is seen that all operations of the company comply with aeronautical law and the dictates of the Bureau of Air Commerce, Department of Commerce. The operating experience of the company is compiled into an "operations manual."

Each line is required to have an operations manual and the information contained therein is jealously guarded by the individual companies. It is easy to understand why, because the manual represents the experience of the company, some of it dearly bought, and all of it gained over a period of years of experience by trial and error.

END

An Inverted Engine

An inverted Menasco engine.

A REQUEST for a description of an inverted type in-line engine is the reason for the photo shown above. As will be seen, the cylinders hang below the crankcase to avoid extension into the air stream.

Speed of Army Pursuit Planes

JUST how fast can our latest Army pursuit planes really go?

That is what the public has been wondering for some time, but the Air Corps regards such information as secrets of war and the official figures are not given out. A few weeks ago, however, there was a good demonstration of the speeds at which these ships will fly.

The Mitchel Trophy Race for pursuit pilots, which has not been flown for the past four years, was held at Selfridge Field last November. All the entries were Boeing P-26A all-metal low-wing monoplanes, and they reached speeds that were a big surprise to most people not in the Army.

The winner, Captain Fred C. Nelson, averaged 217 miles per hour on a sharp triangular course, which, it was generally agreed, probably cut down the straightaway speed of the competing planes by at least 20 miles per hour. Moreover, the throttles were so arranged that they could not be shoved wide open, as these ships are built for high altitudes and if flown at full gun near the earth will burn out their superchargers. Thus the time clocked in the race was far from their best performance.

A better idea of what the little ships are really capable of doing was brought out by a series of straightaway runs over a one-mile course. The best time in this event, won by Lieutenant H. H. Van Auken, was 256.9 miles per hour.

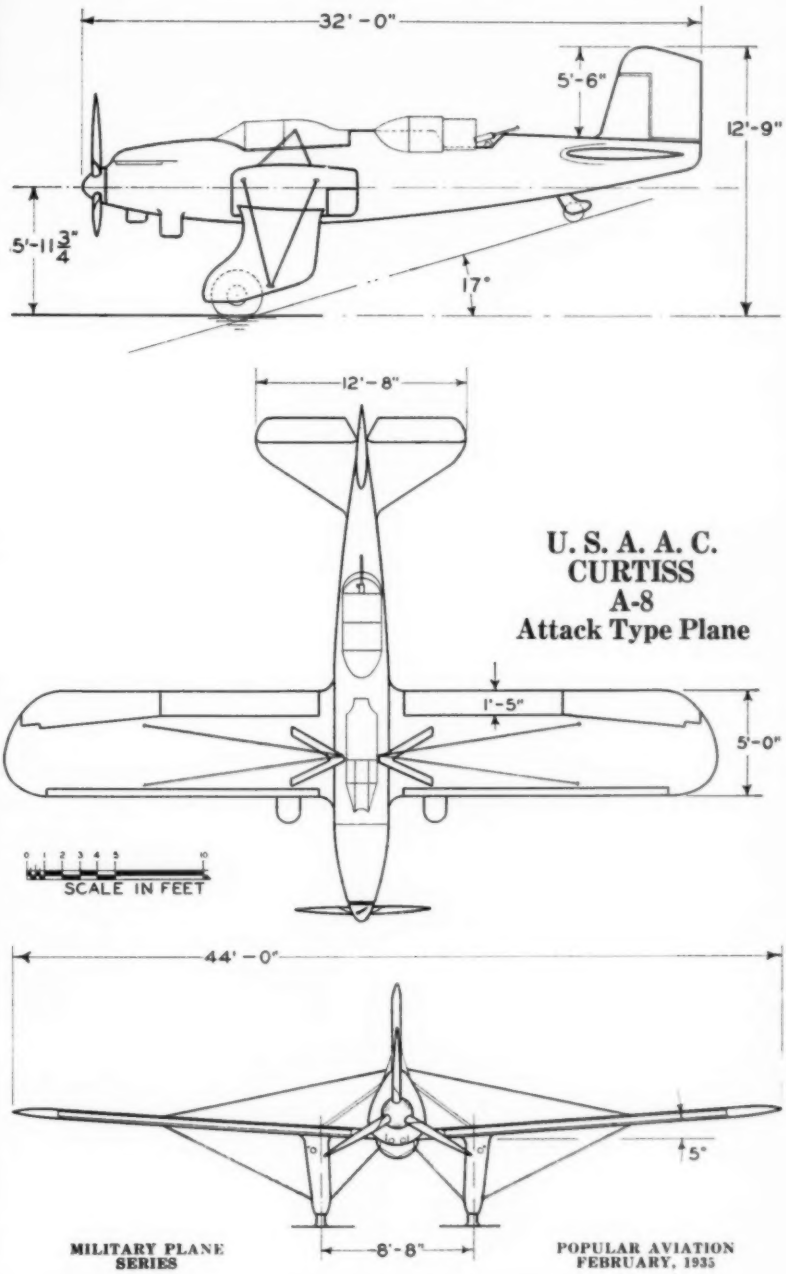
And this is only an indication of what the planes will do when operating several miles above the earth at the altitudes for which they were designed.

Three View Details of the Curtiss A-8

DURING the past two months, we have had many requests for full-scale drawings of the Curtiss A-8 Attack plane. Just why this sudden interest in a relatively old model, we do not know, but the interest seems to be there just the same.

This is the original A-8 Attack plane, not the later model in which many changes have been made. It is provided with a liquid-cooled engine and the armament is somewhat different than the later model. The first A-8's were the pioneers of attack aviation and possibly this is the reason for their present popularity among model builders, photo collectors and others.

The attack planes, as the name signifies, are primarily for the purpose of attacking land troops by both machine guns and bombs. They fight at very low altitudes—only a few feet off the ground—and can develop a tremendous burst of speed, necessary for avoiding the effects of carefully trained rifle fire from the enemy infantry. The bombs are effective in breaking up supply trains, intrenchments, machine gun nests and the like. A sudden surprise attack—and gone is the theory.



And the Dream-Ships Still Come

Below you will find the latest dreams in the way of air-minded dreaming. We have a lot on file, but send your idea in—it might click.

WELL, well, here we are again as the ancient Romans used to say—but they didn't mean it that way. This month the dreamers have been working overtime on all sorts of phantasies, but as our space is limited, we can only show a few of the dream-crates in this issue.

In our correspondence, L. D. F. says of his drawing, "Guess what this is?" Well, we tried but we couldn't guess, so we hope that he will relay the information without further delay. We're curious to know! To let you into the secret, his sketch looked like a bathtub reposing in a forest of propellers with a couple of long dinguses (pardon the scientific terms) sticking out in what we imagine to be the front. Maybe the latter are the feelers or smellers used for blind flying in place of instruments.

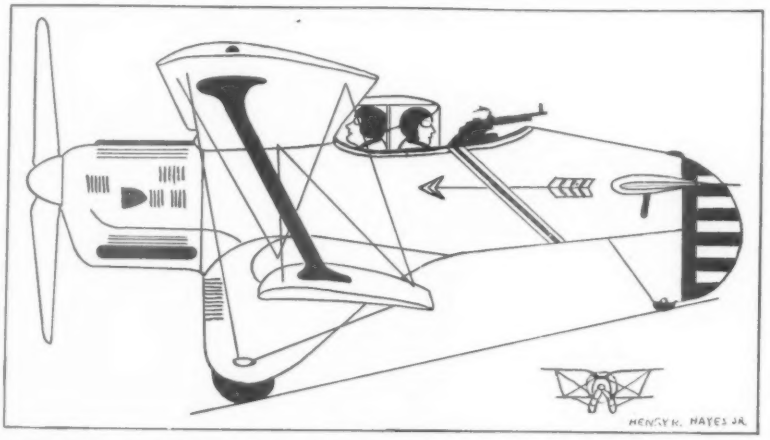
But to get back to this page, we start off with the design of Henry R. Hayes, Jr., who shows a very remarkable tail-group. In fact, the vertical fin and rudder are upside down so that the fin forms a boot for the trail wheel. If he'd just gone a little further and put the wheel in the rudder, he would have a steerable tail-wheel at no extra expense. We don't know how this would affect the spinning qualities but it is an excellent and original idea.

Next comes (or come) H. Dyer and D. Cassidy with a fancy racing job, somewhat like the Gee-Bee including the African Domino marked "32." Whether these boys dream things out in the same room or whether they do solo dreaming is unknown, but here's a nice looking job for your critical perusal. The pilot is a tight fit in the what-you-may-call 'em. With 800 horses in the engine-room, the designers claim a speed of 300 m.p.h. which is bookoo speed in any language. But in dreamland, specifications and performance are mental—not physical.

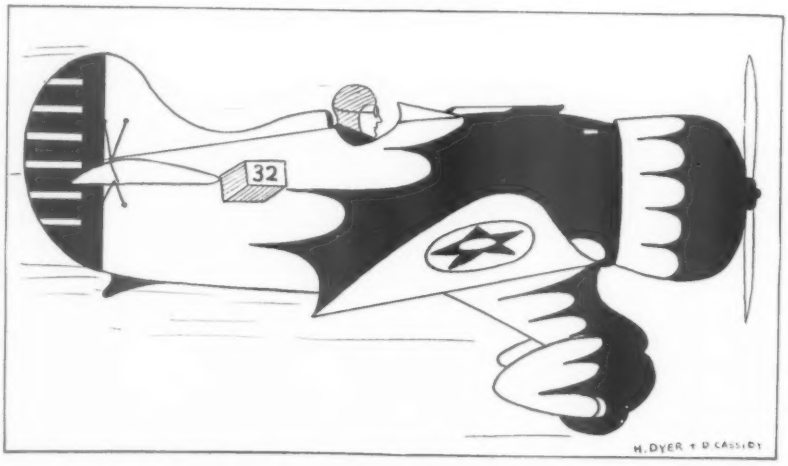
And driving down to the bottom of the pile we find a nice little pursuit job with machine guns planted in all sorts of unusual places. Sorry he didn't put one in the fuel tank to complete the job. But the most remarkable thing about the thing is the fact that he had so little trouble in getting his "NC," something that the average designer has to battle for through long months. But there she is as plain as the sun—NC-7763!

His manufacturing serial number for this production is PZ-3737 which sounds like a good bet in the science of numerology. I'd like to try this number sometime in order to recover from the effects of past cases of bad judgment. Thank you, John. The very next war that we get into will have one of these concealed weapon affairs fooling the enemy into submission. Adios.

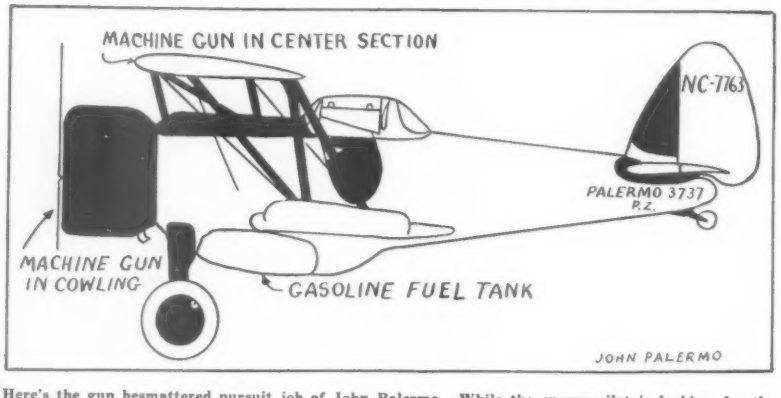
Well, Boys, Look 'Em Over!



Mr. Hayes' idea and motif is predominated by an upside-down rudder and fin. This permits him to push the back-end up in the air which might be a good thing at that. Note the nonchalant gunner with his rear radius unobstructed by the tail.



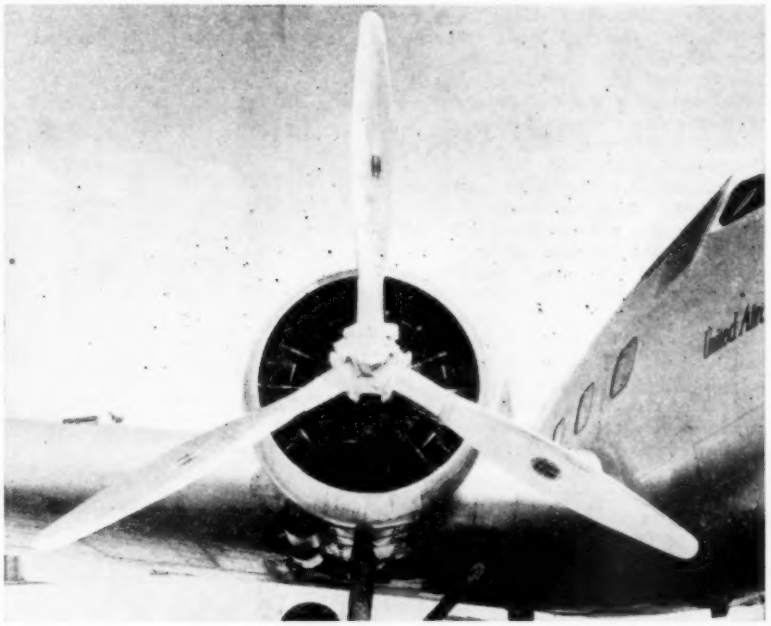
Away we go in a slick looking racer drawn by Dyer and Cassidy. We are undecided as to whether the star beneath the wing refers to the U.S. Army Air Corps or the Texas Oil Company.



Here's the gun besmattered pursuit job of John Palermo. While the enemy pilot is looking for the M.G. on the cowl, he'll get smacked by the cowl gun or the center-section gun.

Operating at Constant Engine R.P.M.

THIS most remarkable improvement in engine control and economy is a governor that holds the engine at a constant speed by varying the propeller load. The governor varies the pitch of the propeller through a hydraulic arrangement and this in turn regulates the load.



This engine, and its companion on a Boeing 247-D transport plane is controlled by the new hydraulic governing system. The governor varies the propeller pitch.

THE first installation of the Hamilton engine governor, for use with the hydro-controllable propeller, has just been tested and completed on the Boeing 247-D, X-13301. This governor is a device that regulates the flow of oil to and from the controllable-pitch propeller to maintain an engine speed easily or a speed selected during flight.

The throttles may be moved, the aircraft can climb, dive or fly level, changing the aircraft speed through a wide range and yet the engines will continue to run at the desired r.p.m. This is primarily accomplished by continuously shifting the movable propeller blades to different settings so that the conditions permit of constant engine speed.

Two levers are placed side by side in the cockpit, connected to independent governors on each of the engines. By moving the levers, separately or together, an infinite number of engine speeds between 1,600 and 2,200 r.p.m. are made possible. The governors are entirely independent of one another and have a pronounced effect upon the operation of the engine and plane.

Control by the governors is affected by allowing them to operate the oil valves that control the admission or drainage of oil from the pitch-controlling hydraulic cylinders on the propellers. These cylinders are so connected to the propeller blades that they rotate the blades, thereby changing the pitch of the air-screws. Governing is entirely automatic with no attention from the pilot except to set the engine on the speed he desires.

If conditions of power, airplane speed, and the desired engine speed are not within the limits of the propeller hubs, the blades will be either at the extreme high- or low-pitch positions.

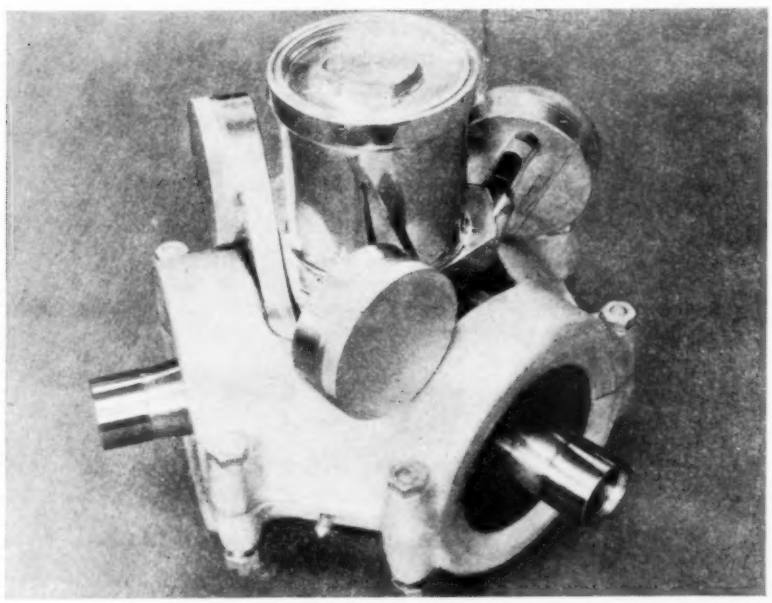
These positions are but little different than the conventional two-position operation of the same propeller. Intermediate pitch positions are maintained carefully by the governors carefully regulating the flow of oil to meet the floating pitch positions between the two extremes. At idling and warming-up speeds, the blades are forced into the lowest pitch since the governor is now asking for more gas than the throttle permits.

Extreme low pitch is still held while the throttle is opened to a maximum unless the governor control is set for some lower engine speed than is attainable with extreme low pitch. In this case, the governor will increase the pitch of the blades by just enough to absorb the power at the desired speed.

The usual range of propeller settings allowed by the hub is such that the maximum engine speed is not quite reached with an extremely low pitch while running-up the engine with the airplane stationary. Operation of the control can be checked, however, by moving the lever to a position calling for a lower engine speed than given by the low pitch if the throttle is opened sufficiently to give an engine speed greater than the governor's minimum speed.

As a rule, a higher ground engine speed is attained with the governor than with the usual two-position operation, therefore, more power is available at the beginning for take-off.

For the take-off, the propeller con-



This is the new governing device, a midget in size but which is capable of controlling the largest airplane engines.

trols are normally set for maximum engine speed, though take-off can also be had with the controls set for cruising speed. During take-off, or soon after, the engines will attain the governing speed and this speed will not be exceeded during the climb nor even when leveling off. During the climb, full advantage is taken of supercharging if the throttle can be opened to maintain full power when the air is thinned out by altitude.

Unless the propeller blades are set at high pitch to hold the power at altitude, the engine will overspeed with the opening of the throttle, while if the blades are set high, then the engine is lacking at speed at low altitudes.

But the governor avoids these difficulties by automatically adjusting the pitch for changing altitudes and throttle openings. A slight adjustment of one or both propeller controls will synchronize the engines, but once synchronized they stay so without further attention from the pilot.

At any time during the climb, the pilot may level off (or even dive) without touching either of the controls and with the engine speed remaining constant or the same as in the climb, even though the airspeed goes up from 100 to 190 m.p.h. Climb can be resumed as easily as flattening out, the prop blades being shifted from near 33° at full horizontal speed to 23° at climbing speed.

The governor controls are almost identical with the throttles in their effect upon the engine speed, and the engine speed can be as easily regulated with these controls as with the old throttles. The handling is simple to learn. If the controls are moved slowly, there is not the same alarming change in engine operating conditions as with the throttle control.

If it is desired to climb to a little higher altitude, the ship will maintain quite a reasonable rate of climb without change in engine speed and the throttles need not be changed. As soon as the speed has settled down, the synchronization beat is as regular as ever with the same engine speed.

The ship may even be put into a moderate dive from a climbing speed of 80 or 90 m.p.h. and allowed to pick up a speed close to 200 m.p.h. and the tachometers will show the same engine speed. Turns, level or climbing, are made without a change in the beat of the engine. The persistency of the tachometers in showing constant engine speed is uncanny.

Throttle positions are not critical. One engine can be throttled until the intake manifold pressure gauge shows 16-18 inches mercury pressure while the other engine is opened up to 32-34 inches and yet the tachometers still show the same speed for both engines. Both throttles can be opened or closed rapidly with only momentary variations in the engine speeds.

(Concluded on page 133)

The "Humming Bird" Cost Only $80

Here is the Humming Bird already to navigate, with one of the owners winding up the prop while the other calls "contact." It's a cute little rig.

TWO boys of San Antonio, Texas, have broken a new record with their home-built lightplane—the "Humming Bird." No, it isn't a speed record, nor an endurance record, nor an altitude record. It is the cost record that they have smashed and they gave Old-Man-First-Cost an awful slap in the face when they revealed that this little ship only cost them eighty dollars.

According to the dope, the boys spent about two years' time on the job, but at least they have had the satisfaction of seeing her take off as the accompanying picture shows. It is powered with a converted motorcycle engine and can be assembled within 30 minutes.

Maybe it isn't just what the Bureau of Air Commerce would be tickled to death about. It has no ATC, and we're willing to bet that no such thing as a stress analysis ever got within gunshot of it, but it holds together and that's something in these days. It flies and the boys have a lot of fun and instruction out of it, so in our opinion the time and money were well spent.

The general outlines of this little ship, with its diminutive power-plant call to mind a similar job built in Chicago a few years ago by two young fellows out of assorted spare parts, wire, wood and sheet metal. These boys had to start in "raw," as it were, for they had about twenty dollars per each, no drawings, no previous experience, no nothing except a vaulting ambition to fly. The engine was dug out of an ancient Model "T," the prop was whittled out by themselves and the purchased accessories were noted by their absence.

Finally, after strenuous laber, they got her assembled and to everyone's astonishment, as well as their own, the little ship flew and flew well at the first attempt. They made a few readjustments here, strengthened her there and fiddled around with the ship until they finally started making money with it by various means. At last they sold it, for about four times the original cost of the materials (they didn't count their labor), and invested the money in a bigger ship. Today, these boys operate a first-class airport.

The Humming Bird just taking off, a picture that proves she can unstick herself from the ground at least.

Features of Lightplane Design

by WILLIAM STIEGLITZ

This is the second article in a series on the design of a lightplane that should be of interest to all students of lightplane construction.

THE general features needed in the small plane for the private flyer were outlined in the preceding article of this series. In order to develop the various points as clearly as possible, it is best to have reference to a concrete case from time to time, so the design of a typical plane will be carried through.

The plane selected will be a tandem two-place open-cockpit low-wing monoplane, with a full cantilever wing having a two-to-one taper in plane form. The power-plant will consist of an air-cooled engine developing about sixty-five horsepower. This figure does not represent the output developed by any particular engine now being built, but is, in the opinion of the author, the minimum necessary for good performance in a two-place airplane. It is perhaps, a trifle low—seventy-five horsepower might be a better figure—but since it was decided that economy was one of the most important features of this plane, it seems best to set the figure as low as possible.

There are unquestionably many readers who will take exception to the type of plane described above, so it seems advisable to spend a short time discussing the features which led to its choice.

There are three definite advantages which come from the use of a low-wing —a low center of gravity, the greatest possible "ground effect," and a maximum of vision.

The low center of gravity does two things—it gives better "power-on" and "power-off" stability and reduces the danger of the plane nosing over in landing. Considering the former, when the throttle on a plane is opened it produces two effects, (1) an increase in the propeller thrust and (2) an increase in the down load on the tail. The latter creates a stalling moment, and when the center of gravity is below the thrust-line, the former produces a diving moment which counteracts the stalling moment from the tail, and leaves the ship in the same attitude.

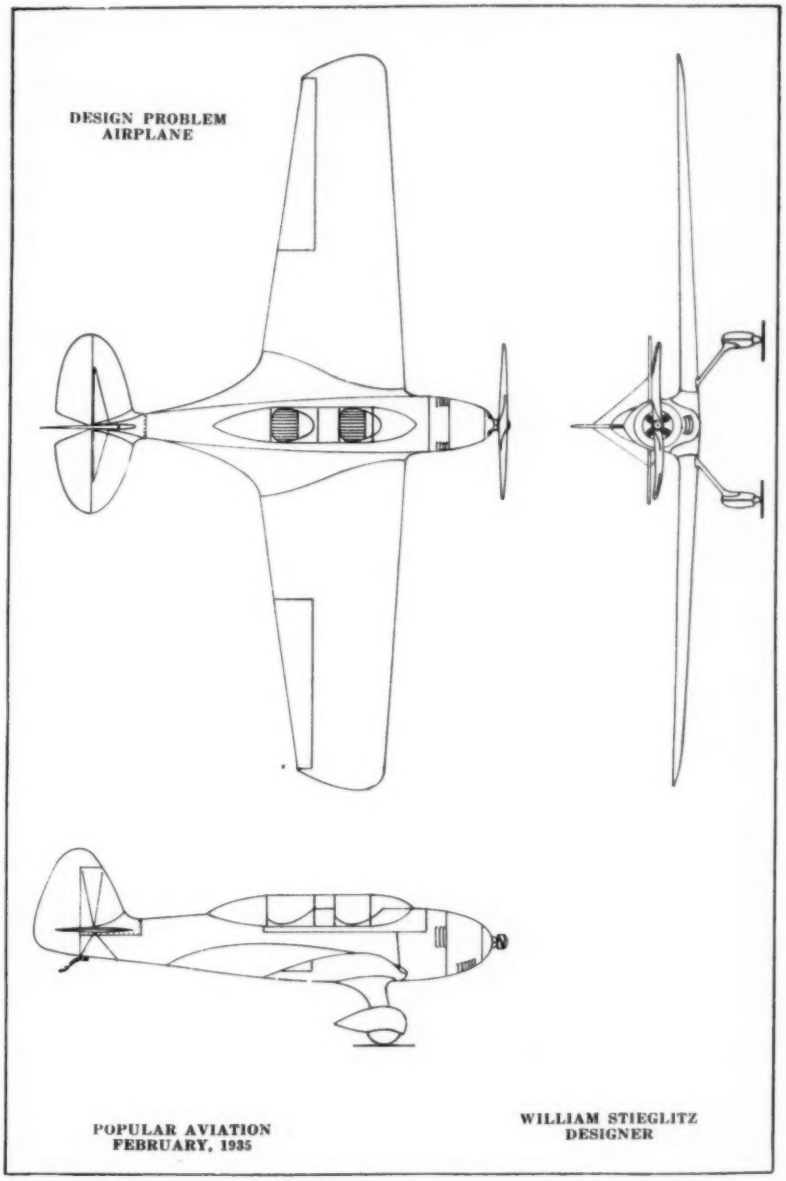
As to the decreased tendency to nose over, anyone who has seen a low-wing plane landed with the tail in the air, and instead of nosing over as most types of planes would have done, merely ground-looped, rocked a bit, and remained right side up, will appreciate what this means to an inexperienced pilot.

The "ground effect," by which is meant the reduction in induced drag when the airplane is close to the ground, is obviously a maximum for a low-wing monoplane, since in this type the wing is nearer the ground than in any other, and results in a decreased landing speed.

This, then, is one way of keeping the landing speed down without using an excessive amount of wing area. As to vision, a low-wing plane gives a maximum in a climbing turn, where it is of vital importance and at the same time, if the cockpits are properly located in respect to the wing, still gives ample vision down.

The choice of a tapered cantilever wing is less readily defensible.

There is no doubt that, unless there is mass production, the tapered wing is much more expensive to build than is a rectangular one. It is also true that a cantilever wing must be considerably thicker than an externally braced one, so that the profile wing drag will be increased. This is offset, in part, by the elimination of wing bracing, but



even so it is a factor of primary importance.

However, there are two important advantages which can be written against the disadvantages just discussed. The first was mentioned in the last article—the distribution of area in a tapered wing is such that the resultant force on the wing acts nearer to the plane of symmetry of the airplane than a rectangular wing, thereby giving smaller rolling moments from gusts of air and makes the plane less subject to weather conditions.

The second advantage calls for a momentary consideration of wing theory. Both from theory, and from pressure distribution tests, it has been found that the ideal spanwise lift distribution is elliptical in form, this pattern giving the minimum induced drag. Of course, the only time that this distribution actually exists is for an elliptical wing.

However, theory, once again borne out by wind-tunnel tests, shows that a wing with a plan form taper between two- or three-to-one, approaches this pattern the most nearly. The induced drag of a rectangular wing of aspect ratio 6.0 is five percent greater than that of an elliptical wing, while that for a wing with a two-to-one taper and the same aspect ratio is only one percent higher than for the elliptical plan form.

Thus, to summarize, the tapered cantilever wing makes the plane more expensive to build, and increases the profile drag, but makes the plane more stable in rough air, and decreases the induced drag. Since the profile drag increases with the square of the velocity, while the induced drag varies inversely with the square of the velocity, the former will be appreciable only at high speeds and the latter only at low ones.

Consequently the effect will be to reduce both the maximum and minimum speeds of the plane. For the purpose of this plane the advantages of the tapered wing seem to outweigh the disadvantages, thereby justifying its use.

It was decided in the previous article that the geometric proportions of the plane should be determined from the calculations for the stick forces, so it is necessary to proceed with that phase of the design before anything can be done toward a layout.

There is only one thing which must first be decided upon, and that is the aspect ratio of the wing. In order to keep the span from getting too large, it is not advisable to use an aspect ratio greater than six, especially since the use of a tapered wing will make the span greater than it would otherwise be.

At the same time using any lower value would tend to offset the increase in efficiency due to the tapered wing. Consequently an aspect ratio of six will be used.

It is now necessary to decide what stick force is desirable at some particular attitude of flight, and since the stick forces are a maximum at landing that is the best criterion. The only way in which to determine the proper force is to determine the value of the force on some plane which, according to the majority of pilots "feels right." A comparison of such values for several planes leads to the conclusion that a stick force between four and five pounds at landing is about the correct value.

In order to derive a method of finding the stick forces it is best to start with an expression for that force and then work back to some equation involving the general characteristics of the plane. This leads, obviously, to the equation for static longitudinal stability, as the expression for the pitching moment of the tail is the only one which will involve the load on the tail and the dimensions of the airplane.

The value of the force which the pilot must exert on the grip of the stick can be expressed by the equation

$$F = kH/L \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

F = Force on stick (lbs.).
H = Elevator hinge moment (inch-lbs.).
L = Length of stick (in.).
k = Gear ratio in control system.

Expressing the value of the hinge

(Concluded on page 120)

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-41

Barrel Roll. An aerobatic or stunt maneuver in which the airplane continues along a horizontal straight line while the wings rotate laterally about this flight line. There are two rolls: (1) The slow roll and (2) The "snap-roll." The latter is really a spin around a horizontal axis.

Base. (1) The headquarters from which airplanes operate. (2) A chemical term for a substance that reacts with an acid to form neutral bodies known as "salts." (3) Foundation or bottom support.

Basic. Fundamental principle or fact.

Basic O.H. See BASIC STEEL.

Basic Steel. Open-hearth steel produced in a "basic furnace," that is, in a furnace provided with a basic or alkaline type lining and which is charged with dolomite.

Basin (Model). A long narrow water-tank in which models of hulls and floats are towed to determine their resistance.

Basket. A wicker-work car carried by a BALLOON provided for carrying the passengers.

Bat. (1) (abbrev.) BATTERY. (2) A mouselike nocturnal flying animal having membraous wings. Order Cheiroptera.

Bat-boat. A nickname given to an early flying boat built by T. O. N. Sopwith in England.

Bat-wing. An airplane having short broad wings, or wings completely embracing the fuselage from front to rear like the wings of a BAT.

Battery. (1) A number of connected units in a row or compactly assembled. (2) A number of chemical electric cells connected together to obtain the required total voltage or current by various combinations of the cells.

Battery (Electric). A number of electric cells connected together electrically, to obtain a greater voltage or current than given by a single cell.

Battery Electrodes. The plates immersed in the battery solution between which an electrical difference of voltage is created by the solution. Connections are made to these plates for the external circuit. There is one positive and one negative electrode in each cell. Sometimes known as "plates."

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-42

Battery Electrolyte. The solution in an electric cell. In a storage cell this is usually a solution of dilute sulphuric acid.

Battery Hydrometer. A graduated float for determining the density of the ELECTROLYTE of a storage battery. The amount of charge in the battery is directly proportional to the density.

Battery Ignition. An ignition system for engines in which the current is supplied by electric cells.

Battery Polarity. The direction of current flow from a battery, positive to negative connections. In a PRIMARY BATTERY, the positive pole is the copper or carbon electrode. It is common practice to paint the positive pole (POS) a bright red color.

Battery (Primary). A chemical cell in which one of the electrodes is entirely consumed at the end of discharge. Usually, the negative electrode is zinc while the positive electrode is carbon or copper. The ordinary dry cell is a primary battery.

Battery (Secondary). Also known as a storage battery. The plates are usually of lead in a solution of dilute sulphuric acid. When discharged, the charge is renewed by passing a "charging current" in the reverse direction through the cells. The electrodes can thus be used repeatedly.

Battery (Storage). See SECONDARY BATTERY.

Battery Voltage. The voltage of a PRIMARY BATTERY CELL ranges from 0.50 volt to 2.2 volts, depending upon type. The voltage of a single storage cell, fully charged is 2.0 volts. A number of cells can be connected up to form a "battery" so that to total voltage or the total current is greater than that of a single cell.

Baume' Gravity. An arbitrary scale of densities for liquids in which the density of pure water is 10.0. This scale is used for indicating the density or gravity of gasoline and the various petroleum products. This is not SPECIFIC GRAVITY.

Bay. The space between struts of a biplane taken along the length of the wing.

The National Glider Movement

by "SPEED" WESTPHAL

The author is promoting a glider revival for young men who wish to enter aviation by the simplest and most economical route. Write to Mr. Westphal for his plan, addressing him at the offices of POPULAR AVIATION.

WELL, guys, here I am again and believe you me, if the editor of this "mag" said I could have every page, I still wouldn't have sufficient space to give you all the dope on this thing.

Letters pouring in from all points of the compass, including plenty of towns I've never heard of. Nevertheless, they are plenty welcome and the more the marry her—er—pardon me, I mean merrier, or however it goes.

The editor said he'd give us space if we showed him interest, so, come on, invest three cents. Tell me if you are interested in gliding, if you would like to join a club, if you would like to have me help you organizing one, if you would like to contact an old gliding friend or any other interesting item concerning gliders and gliding.

The first fellow to spot-land on this month's page is Ben Levene, president of a very active club called the "Manalive Glider Club," located at Paoli, Pa. (Mailing address, 53 N. 61st St., Phila., Pa.) I wish I had room to print his letter in full. He tells me the club has several gliders, including a two-place primary which is used for instruction and passenger carrying.

The members of the club, including Joe Yarnall, Bob Brown, Mose Morris, Joe Bender, and Harold Swift, are all licensed glider pilots and have not as yet, completed an outside loop, but as I look over the list of maneuvers they have done, I would suggest they save the outside loop for some day when they're all down in the dumps and want a new thrill.

Just reading about it makes me want to do an ostrich hide-out under a "chuck-block" or an oil barrel. Anyway, I'm going to keep his letter right out on top and when I get the first chance, I'm going to let you see it. Incidentally, Ben, you might send me a few snapshots.

Now I will answer a few questions which seem to be general among the letters I have received. First: does a glider have to be licensed to be flown on private property? The answer is yes and no, depending on the state in which the flying is to be done. Some states, such as Illinois, have their own laws, demanding all aircraft be licensed before being flown. I have no way in which to secure a list of other states having the same laws, so would suggest you write to the Department of Commerce, Bureau of Air Commerce, Washington, D. C. I am sure they will be able to furnish you with the desired information.

In regard to the question of constructing gliders of your own design,

Here we are in full flight, a self-photo taken from the wing tip of a glider.

I would suggest you forget this idea, especially if you reside in a state demanding a license on same. I have seen, during the past seven or eight years, many broken hearts, broken bones and head-aches caused by this method of procedure.

An intricate set of blue prints and information sheet must be furnished the Department of Commerce. True, these can be secured, but only at great cost. I quote in part, Section 1 of the Government bulletin No. 7-A which is just off the press:

"Because of the wide variation in type and purpose of modern gliders, it is considered inadvisable to include a specific set of regulations covering this class of aircraft. When approval of a glider is desired, data should be submitted outlining the type, method of construction, approximate dimensions, and other pertinent information. Upon receipt of such data, the necessary requirements will be determined."

Well, I'll be chucking my blocks for this month, but don't forget to drop in on me next month, and keep those letters coming in, or else.

Another glider-hopper to contact up that way is Leon Yates of 34 Cresent Ave., Woodbury, N. J. He has ideas, a place to construct, and a place to fly. Drop him a line, boys, drop him a line.

* * *

Now, for the benefit of all you birds from New York that wrote in, saying you would like to contact an active club in your locality. Here's one in Jackson Hts., L. I., N. Y., that sort of gives you the idea to why I first went to the editor of ye old POPULAR AVIATION several months ago. I quote in part, this bit of ink donated by Arthur Ramer, secretary of the Airhoppers Glider Club, 9608 31st Ave.:

"Your article in the December issue of POPULAR AVIATION is the most welcomed and promising news I have come across since those almost-forgotten days of 1930, when gliding activities drew sufficient interest to have entire issues of publications devoted exclusively to the glider movement. It was not so long ago that regular monthly articles on gliding were published by leading magazines and I for one can assure you those articles are greatly missed by all of us fellows. We need your help to inform the public that gliding is no longer a plaything."

Un-quote—or whatever you say when you're done quoting. The club has a primary, secondary, and soarer, so I puts the O.K. on them and hope I hear more about their success in the future. (How about some pictures?)

* * *

You stick-squeezing guys down in Daytona Beach, Fla., better get in touch with Harold Paynter, Box 1427. He has the place, ambition, and cash to build a swell glider, but needs a little technical assistance. Go after him, boys, he's a real Santa Claus.

* * *

"Ted" Berryman of Orlando, Florida, has the tow-car, rope, field, and ideas. Organize, you birds, organize.

* * *

Going over to the west coast, the rudder kicker I puts the O.K. on is S. O. Lombard, 525 Stockton St., San Francisco, Calif.; Alfred Smith, a swell fellow that works in the Sound department of the M.G.M. studios at Culver City, Calif.; and William Briegleb, employed in the Production department of M.G.M. at Los Angeles, Calif. Mr. Briegleb is looking for some young, active fellows to help him finish a sailplane for which he has all the parts already purchased. He tells me, it won't cost the newcomers a penny.

You two M.G.M. men should get together. A bit of sound and production should go a long ways, don't you think?

* * *

Mr. Ira C. Byrd, who is at present in the grocery business down in Winchester Bay, Oregon, tells me he would like very much forming a club in his locality, and believe me, that's no bologna.

END

XUM

He Sells Sign-Writing Machines by Plane

MILTON REYNOLDS, Chicago, Ill., manufactures a sign-writing machine which he sells to department stores. This machine weighs about 300 pounds. It is impracticable to carry it about for the purpose of demonstration.

To surmount this handicap, Mr. Reynolds some time ago wrote and produced a motion picture which shows his machine and its important features under actual operating conditions in a number of prominent stores.

But even motion pictures did not wholly solve the matter of demonstrations, for sometimes a prospect insisted upon seeing an actual machine. To make this an interesting possibility, with a minimum of inconvenience for the prospect, Mr. Reynolds purchased a four-passenger Stinson "Reliant." Now he flies his prospect to the nearest city in which he has a machine in operation. Over two hundred department store executives have thus ridden with Chicago's "flying salesman."

Mr. Reynolds recently established a record unique in the annals of private flying. Up to September first of this year he officially logged 800 hours, during which time he flew 99,782 miles. This is possibly the greatest single-year mileage flown by any private plane in the United States.

Within a year he accomplished two transcontinental trips, two trips from Chicago to Mexico to Chicago, two trips to Miami and return, sixty trips over the Allegheny Mountains, and four trips to Canada and back to Chicago. He has landed at least once in every important airport in the United States. Mrs. Reynolds and their two children, Marjorie, 17, and James, 11, have accompanied him for a total of 20,000 miles.

Although able to take the "stick" himself, Mr. Reynolds never goes aloft without his pilot, Gus Palmquist, who formerly flew for the Chicago *Daily News*. They have never had a forced landing. They have experienced a number of "thrills" but have never been in actual danger.

This is just one more example of the possibilities of using an airplane in business, more particularly in the sales end of a business. We have records of sales officials selling such merchandise as radios, washing machines, printing presses, farm produce, shoes, beer, women's wear and many other diversified lines by the air route.

Almost any commodity can be handled successfully in this way, from articles so small that samples can be carried directly on the plane to those requiring inspection trips of the kind specified above.

A Canadian Static Trainer

OUR Canadian friend, Wellington Smith, Fort Frances, Ont., sends us a picture of a miniature flight trainer that he has built and operated. This is a highly ingenious arrangement that should appeal to our model builders.

When the "pilot" operates the controls on the model, it climbs, dives, banks, and turns in a realistic manner, giving actual experience in handling the controls and showing how these controls function. Mr. Smith says that the model is not difficult to build after the idea is worked out.

But, our Canadian friend has another item of interest in his letter. He asks us if we would like a snapshot of the sidewall in his den on which he is displaying pictures taken from POPULAR AVIATION. We most certainly would like to see these snapshots and urge Mr. Smith to send them in so that the rest of you collectors will get ideas on the subject.

We are always interested in any new departure in model building that is sufficiently original to get well away from the beaten path. Model building covers a big field and modelists are missing many very interesting possibilities when they ignore original research work. We are quite surprised that trainers and miniature wind-tunnels have been so long neglected.

And so, we'd be glad to receive any novel ideas in model building from our readers.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-43

Beacon. A light or other signal for the guidance of aircraft.

Beacon (Radio). A beam of radio waves traversing a given line of travel employed for the guidance of aircraft. This is also called a "radio lane."

Beam. (1) A ray or streak of light or radio waves. (2) A structural member in which the load is applied at right angles to the length of the member in such a way as to cause bending. (3) The side of an airship.

Beam (Cantilever). A beam loaded at one end and supported at the other.

Beam (Continuous). A single beam carried by a number of supports.

Beam ("I"). An "I" beam has a sectional form similar to the letter "I." It consists of one deep vertical "web-plate" and two "flanges" at the top and bottom of the web.

Beam (Hollow). A beam having a hollow or box-like section which is extremely light for its strength.

Beam Section. The form of a sectional view of a beam. This refers to the shape of the section rather than to measurements.

Beam-wind. A wind coming against the side of an airship. A side wind.

Beam (Wing). The main beams in a wing structure, commonly called "wing-spars." These beams transmit the loading from the wing surface to the fuselage or load.

Bearers. Beams for the support of an engine.

Bear. To be directed along a certain path.

Bearing. (1) A support for a revolving shaft in which the shaft can turn or slide. (2) The amount of surface subjected to a crushing force (bearing area). (3) The direction of a path or body measured from north or from a meridian.

Bearing (Annular). A ring-like BALL BEARING for the support of shafting.

Bearing (avigation). The direction of a flight path in respect to true north (0°), otherwise known as the AZIMUTH. Its two points, (A) and (B), are connected by a line or circle, the angle made with this line and the meridian is the bearing of the path.

GLOSSARY OF WORDS, TERMS AND PHRASES—DIC-A-44

Bearing Liners. A thin layer of soft ANTI-FRICTION METAL around the inside of a bearing and in contact with the shaft. This metal may be bronze, babbitt metal, etc.

Bearing Load. The load coming on the rubbing surface of a bearing, usually expressed in terms on pounds per square inch of PROJECTED AREA.

Bearing-metal. See ANTI-FRICTION METAL.

Bearing (Outboard). A bearing for carrying an extended shaft and placed outside of the machine proper.

Bearing (Plain). A simple cylindrical bushing placed over the shaft, the shaft rubbing inside this bushing. The simplest form of bearing.

Bearing (projected area of). The projected area of a bearing is equal to the diameter of the bore multiplied by the length of the bearing surface. It is not the superficial surface.

Bearing (Radial). An annular type of ball bearing arranged to take the transverse or loads at right angles to the length of the shaft. The supporting bearings for a horizontal shaft.

Bearing (Roller). A type of bearing in which rollers are placed between the shaft and the main bearing, the rollers converting the motion into rolling friction instead of rubbing friction.

Bearing of Rivets. The area of a rivet that resists crushing stresses.

Bearing Rubbing Velocity. The linear speed of the shaft circumference within a bearing in terms of feet per second.

Bearing Shell. A thin metal shell, usually of bronze and faced with babbitt metal, that fits into the bearing proper. They form a means of replacement against wear.

Bearing (Spigot). A small projected end of a shaft that is inserted into the end of another shaft for holding the two shafts in alignment.

Bearing Speed. See BEARING VELOCITY.

Bearing Surface. Any surface supporting a compressive load.

Bearing (Thrust). A bearing designed for taking the end load or end motion of a shaft.

Dr. Spratt's Remarkable Airplane

by THOMAS SKILTON

A description of a novel plane constructed by a pioneer in aviation. From the wing-section employed to the method of control, this plane bristles with novel and unusual points.

DR. GEORGE A. SPRATT, Coatesville, Pennsylvania, has developed what is probably the most "versatile" airplane in the world.

To begin with, the Spratt ship uses the old circular-arched wing surface which early designers tried so hard to perfect, but which they could not control. Dr. Spratt, through many trying years of quiet experimenting, achieved the apparently impossible with this surface by distributing the weight so that it would be centered directly below the center of lift. Through this surface, the ship is made virtually fool-proof.

When I first saw this ship it was a glider, and had a much larger empennage than that shown in the photographs. When I went to Coatesville Airport to interview Dr. Spratt for POPULAR AVIATION'S readers it had a small, 25-h.p. four-cylinder converted Henderson motorcycle engine mounted in tractor fashion.

While I was there, Dr. Spratt's son flew it with and without a tail. At this writing it is a pusher with the same engine, clipped wings, and flying "tail-first"! What is to come next, we can only guess.

Its most distinctive feature, however, is its lack of conventional control surfaces. This latter feature is unique in itself. Lateral stability in the craft is inherent, while turning it in the air is accomplished by tilting the wings from side to side. The action of the elevators is replaced by tilting the wings up and down.

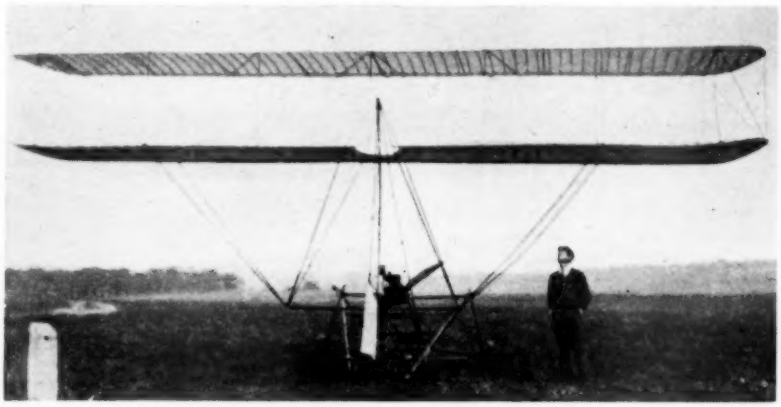
The conventional joy-stick is replaced by a horizontal metal bar, which is connected to the wings by eight vertical metal struts. Pushing this bar forward increases the angle of attack, and the ship climbs. Pulling it toward the pilot decreases the angle of attack, and has the opposite effect.

The present model, although nowheres as speedy as subsequent models will probably be, lands in little over its own length, and Dr. Spratt intends to keep the landing speed down in that neighborhood, widening the speed ratio, possibly, as high as 5-1.

Dr. Spratt predicts that all light-planes of the not-too-distant future will be equipped with this surface and method of control, but larger planes will for a time adhere to the present methods of control and lift.

This is a true tailless type of plane totally unlike the so-called triangular shaped "tailless" planes in which an effective tail-group is formed by the prolongation of the trailing edge. There is neither an independent elevator, rudder nor aileron. The main lifting surfaces perform all of the necessary control functions as well as the lifting force.

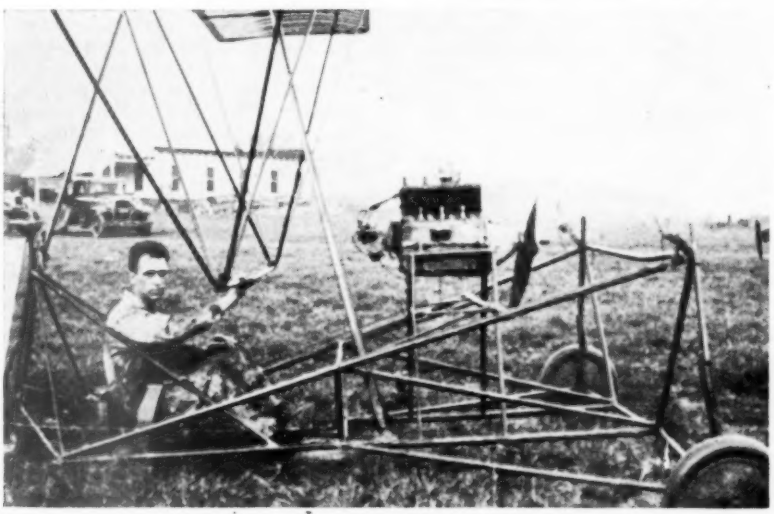
Much of the stability is undoubtedly "pendulum" stability due to the low position of the center of gravity, which would prove impracticable with any other type of wing, but which does not seem to be disturbed in the Spratt plane. With standard rigid wings, the tendency of the low c.g. would be to exaggerate banked turns and to sustain oscillations.



Front elevation of the Spratt low c.g. biplane.

Spratt plane taking off on test flight.

EDITOR'S NOTE. POPULAR AVIATION *has just been informed of the death of Dr. Spratt, associate of the Wright brothers and pioneer aeronautical engineer, and wishes to extend its sympathy to his many friends and relatives. The aeronautical world has lost a very colorful figure and valuable asset to the industry and feels it greatly. May he rest in peace.*



The fuselage or nacelle of the Spratt biplane in which the pilot is seen grasping the articulated wing controls. A Henderson motorcycle engine provides the power.

Building the Corben Super-Ace

by O. G. CORBEN

This is the first article in a series of articles dealing with the construction of this excellent little Ford powered monoplane that has the lines of a miniature pursuit ship.

A LITTLE over a year ago I had the pleasure of giving you, through the efforts of POPULAR AVIATION, a series of plans for building the Corben Junior-Ace. To date, I have received several pictures of the planes which were constructed from the articles.

Photographs and letters came in from Canada, Hawaii and all over the world, which goes to prove that a great amount of interest is shown in a plane which does not cost a small fortune to build or operate. The main drawback seemed to be the expense of a suitable engine.

It is with pride, therefore, that I give you the first drawings for building my latest brain child, the "Super-Ace," a smart racy little sportplane powered by the old reliable Ford motor with a few gadgets added—mainly a propeller—which makes a good but inexpensive power plant.

The Super-Ace is not just a big idea put down on paper with the hope it would work out okay should anyone try to build it. Instead, the ship was built and tested before a detailed drawing was even thought of, so you can start to build your ship with the utmost confidence that, when it is completed as per the plans, you will not only have a fine looking little plane but one which will fly equally as well.

However, my only suggestion and advice is that you follow every detail of the drawings. Otherwise, you stand a good chance of wasting not only your time but the money you put into your ship to say nothing of a good chance of occupying a room in some hospital for a week or so. Stick to the plans and I guarantee you will be rewarded in the end.

Since the Super-Ace was announced in this publication last month, the Postman is getting round shouldered bringing all the inquiries regarding the ship and motor. Most of the letters are from fellows who have been waiting for just such a sportplane, while on the other hand some are from the type who would like something just a little different than what you have. They want to know why we did not do this and that, why didn't we make the fuselage of wood, why didn't we put the wing here or there, and dozens of other questions which would keep three fellows busy trying to answer.

So-o-o-o-o (pardon to Ed Wynn) let me say before we go any farther that the Super-Ace was developed out of years of research in the lightplane field. We have tried, to the best of our ability, to give you a real sportplane of combined desirable features and it must be understood that, like human beings, no airplane can be perfect. But the Super-Ace doesn't miss it very far.

Side elevation of the sporty looking Corben Super-Ace.

I believe that the biggest squawk will be that the ship is not a two-place job. Naturally, this would be a desirable feature but on the other hand the disadvantages such as weight, etc., would make it impossible to obtain a good performance, such as the Super-Ace has, therefore, we designed our ship for a sport and solo plane for the person who wanted a plane in which he could get out and skim through the air, putting the scenery behind the tail group at 100 per.

Perhaps you may be under the impression that the Super-Ace is a hard or tricky plane to fly but I will put you at ease when I tell you that students, with only two or three hours' solo, have flown this little job without the slightest trouble. It is as stable a plane as ever left old Mother Earth; in fact, it will fly hands and feet off the controls and will right itself when disturbed by rough weather. That is better than some big ships I have flown.

Taking for granted that you are well sold on the ship and all its features (even if it is a single place job) I will give you some of the high spots in the construction of the plane. We are starting off by supplying the drawings of the wings, for if we gave you the details for building the fuselage first, we are afraid you would build the fuselage up and then get so busy sitting in it doing ground flying, down in the basement or wherever you chance to be building your ship, that you would not find time to finish the wings. In the end, your Super-Ace would likely turn out to be an ice boat or something of the kind, so you will have to be content by building up the wings first and doing your ground flying from the three view drawing and your imagination.

We have tried to make the drawings as clear and well detailed as possible. Therefore, we do not think it is necessary to take up a lot of space telling you how to hold the nail with one hand and the hammer in the other and all that sort of thing. As we go along, your attention will be called to the most important or difficult things and we feel sure you can obtain the rest of it from the plans.

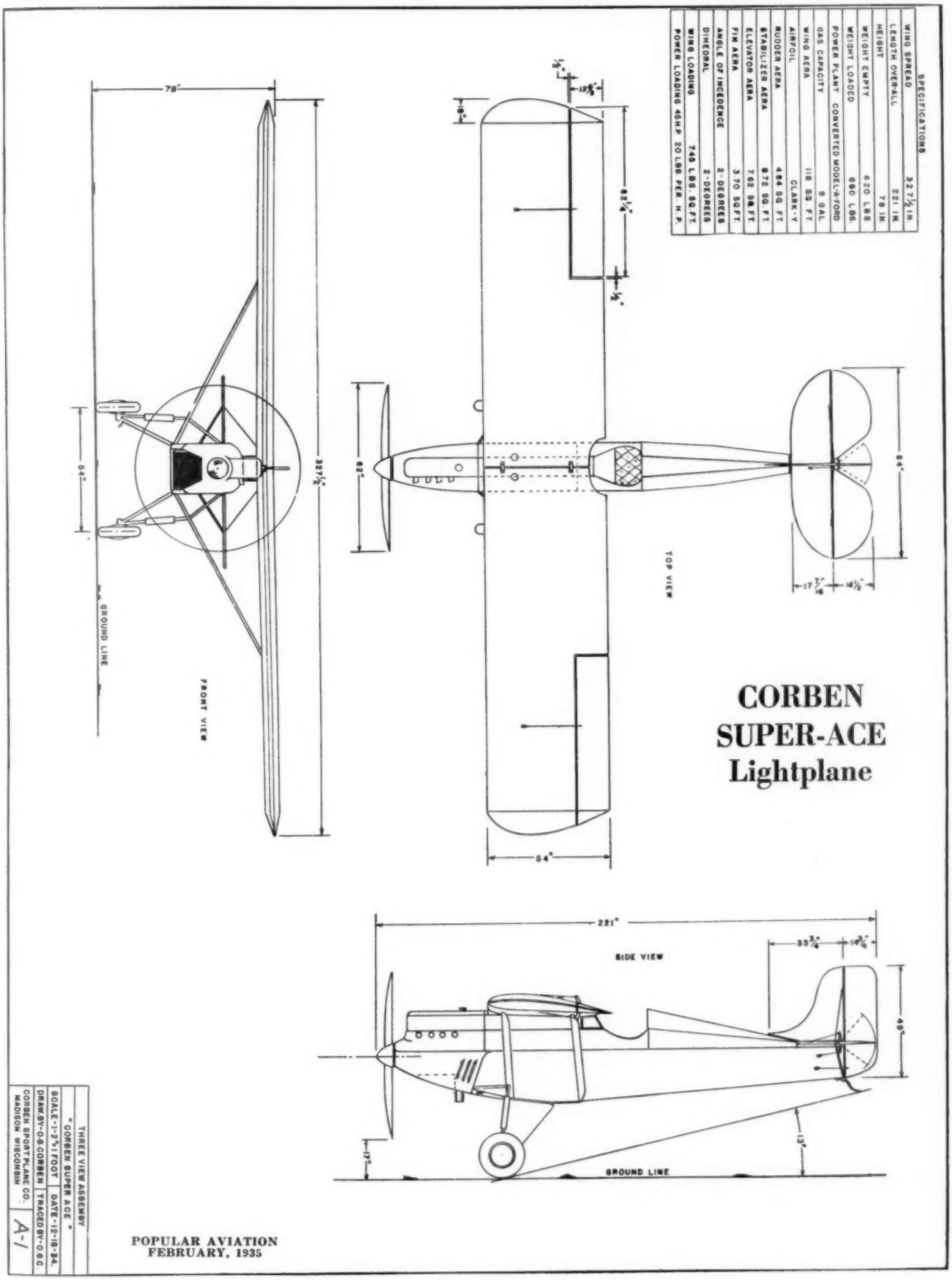
The wings are built up of spruce. Grade A aircraft spruce must be used as it is not only lighter but much stronger than ordinary spruce. Drawing No. 2 shows you the necessary ribs used in the wing, giving you the number required of each. You will note that the ribs are all the same in shape.

The root-end rib varies at the trailing edge so as to make the "cut-away" at the cockpit. The aileron rib is different from the rear spar to the trailing edge as to the spacing of rib braces. The compression ribs are nothing more than regular ribs with the spruce compression members nailed and glued to the rib braces as detailed.

In building up the compression and root-end ribs it is necessary to build them so as to have half for the left and right wing, that is, on the root-end rib, the compression members are to the inside of the wing, therefore, it is necessary to make one with the compression members on one side and the other on the opposite side, the same applies to other compression ribs.

The gussets are of 1/16-inch aircraft plywood, these may be cut with a saw or pair of tin snips. Cement coated nails ¼-inch x 20 gauge are used for connecting the parts.

General Layout of the Corben Super-Ace



POPULAR AVIATION
FEBRUARY, 1935

Wing Rib Details of Corben Super-Ace

WING AND RIB DETAILS
"CORBEN SUPER ACE"
SCALE - NOTED
DATE -12-18-34
DRAW BY - O.G. CORBEN
TRACED BY C.B.C.
CORBEN SPORT PLANE CO.
MADISON WISCONSIN.
A-3
CAP STRIP
RIB BRACE
1-4" NAILS
CAP STRIP
GUSSET
PLYWOOD GUSSETS BOTH SIDES
LEADING EDGE
5-8" 20 GA. NAILS
DETAIL FOR ATTACHING LEADING EDGE SCALE - HALF SIZE
FRONT SPAR
1-4" OIG ALUM TUBE
LEADING EDGE
FALSE RIB SAME CURVE AS RIBS
FALSE RIB DETAIL - SCALE HALF SIZE FASTEN AS SHOWN USE 1-2" 20 GA. NAILS
SOLDER
3-8" CLIPS
1-2" 20 GA NAILS
TRAILING EDGE DETAILS - SCALE HALF SIZE TRAILING EDGE & CLIPS ARE MADE OF 28 GA. GALV. IRON.
LEADING EDGE DETAIL SCALE FULL SIZE MATERIAL WHITE PINE
TIE ROD END BLOCK
3-4" 18 GA NAILS
METHOD OF ATTACHING RIBS SCALE HALF SIZE
NOTE-HOW RIB BRACE IS CUT FOR TIE ROD BLOCK
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
54"
DETAIL OF FULL LENGTH RIB NO.10-12 REQUIRED
3-4" SQ. SPRUCE
DETAIL OF COMPRESSION RIB NO.12-6 REQUIRED
3-4" SQ. SPRUCE
DETAIL OF ROOT END RIB NO.16-2 REQUIRED
DETAIL OF AILERON RIB NO.14-6 REQUIRED
3-4" SQ. SPRUCE
DETAIL OF AILERON COMPRESSION RIB NO.13-2 REQUIRED
5-8" SQ. SPRUCE
DETAIL OF REINFORCED AILERON RIB NO.25-2 REQUIRED
ALL RIB DETAILS SHOWN ABOVE - SCALE 3-16" = 1 INCH
COMPRESSION MEMBERS ARE NAILED & GLUED TO RIB BRACES
AS SHOWN USE 1-16 GA. NAILS. CAP STRIPS & BRACES ARE 1-4" SQ.
SPRUCE GUSSETS ARE 1-16" MAHOGANY PLYWOOD USE 1-4" 20 GA. NAILS
POPULAR AVIATION
FEBRUARY, 1935

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Here Is What They Write

ROBERT JAHNKE, Cadott, Wis., has sent us a shot of his parasol plane that he designed and built last summer. It has a top speed of 85 m.p.h. and cruises nicely at 70 m.p.h. To make matters still more interesting, Mr. Jahnke states that he learned to fly it himself without any previous instruction whatever and that the ship handled perfectly from the start. A number of flights have been made since that time without a single crack-up.

The engine is a two-cylinder opposed type which he built himself. It turns a Heath B-4 prop at 3,000 r.p.m. and consumes only two gallons of gasoline per hour. He says that this gives the little 28-foot span ship plenty of soup for it takes off after a run of 100 feet and climbs rapidly. And this is just one more instance, out of many, where a young man constructed his own ship and learned to fly with it without mishaps of any sort. Wonder why it is that the big manufacturers and the bigshots in aviation have so much trouble when raw amateurs get away with it repeatedly?

E. W. Thomas, 3082 No. 20th St., Kansas City, Kans., has sent in a picture of the Henderson-powered sportplane that he built. At the date of his letter, he says that he has built up about ten hours time on it and that it has been flown by several experienced pilots who have pronounced it O.K.

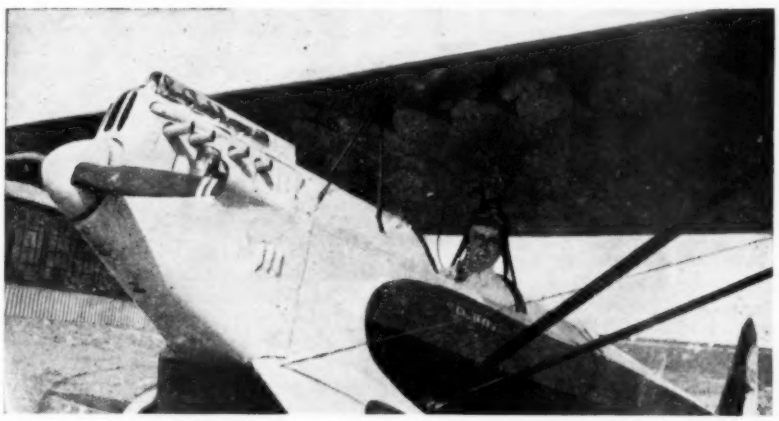
He also says that he has used a lot of the data collected from P.A. in the construction of this ship and that he is looking forward to more articles on this subject.

Last, but not the least by any means, is the Model "A" Ford-powered plane designed and built by C. N. Fast and Royal J. Reck, 109 So. Martha St., Angola, Ind. They have flown this ship cross-country and now they have 108 hours on it. It has a top speed of 90 m.p.h., a cruising speed of 80 m.p.h. and a landing speed of 35 m.p.h. By improving the volumetric efficiency of the Ford engine, they are getting 45 m.p.h. at an engine speed of 2,000 r.p.m. The gasoline consumption is four gallons per hour and the ship has a cruising radius of about 200 miles.

The wing span is 31'-3" with a 6'-1" chord. Keeping an aspect ratio of 5.0, they are convinced that, for ships having a wing-loading of less than 6.0 pounds per square foot, the low aspect ratio gives much better lateral control and stability in rough air than with a higher aspect ratio. They say that they cannot get the ship into a whipstall because the nose drops and it recovers flying speed with less than 100 feet loss of altitude.

Take a Look at These Fine Ships

Robert Jahnke built this ship and motor. You don't often find this combination in an amateur job.



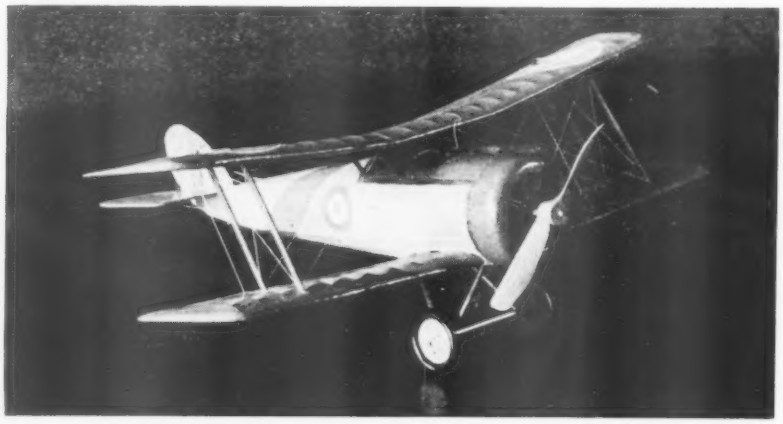
This is the business end of Thomas' ship, a mighty slick cowling job for an amateur.

Propelled by a converted Ford engine, appropriately built by C. N. Fast, this little ship does her 90 m.p.h. top speed. It has a cruising range of 200 miles.

A deHaviland "5" Model

by
JACK KNOBLE

Associate model editor of
POPULAR AVIATION.



This deHavilland "5" wartime plane model is a very attractive layout for the builder.

THE deHaviland "5" was an English Pursuit plane used during the World War. It was powered with a 110 h.p. LeRone motor and had a wing span of 25 feet, 8½ inches and a length of 22 feet overall. This model is exact ¾ scale and its flight performance is very unusual considering the negative staggered wing.

CONSTRUCTION OF FUSELAGE

Construct the sides in the regular way, pinning your longerons and crosspieces down flat on the plan. Use 1/16-inch balsa strips and construct the second side on top of the first. When they have thoroughly dried after cementing, remove them from the plan and cut them apart. Measure off the body spacers from the top view of the plan and join the two sides to form a square secondary fuselage.

Be sure that the secondary fuselage is thoroughly dry and perfectly in line, then trace off the formers on a piece of 1/16-inch sheet balsa and cut them out, next cementing them to their proper positions on the secondary fuselage you just finished. On top of the fuselage between formers 1 and 4 solid balsa is used. It is carved after you have cemented the block in place and all the fuselage stringers are in place and cemented. Notice that the turtleback is constructed of 1/32- x ⅛-inch strips. When they are cemented in place they should stand out from the formers about 1/32-inch. The wing seat should be braced with heavy balsa strips cemented inside the fuselage.

EMPENNAGE

Ribs for the rudder and elevators are cut from 3/32-inch sheet balsa. Cement them in first, then trim them down to the proper camber after they have dried in place. The entire rudder and elevators are built up from 3/32-inch balsa sheet and strip and are afterward sanded down to the proper camber. Cover the rudder and elevators with superfine tissue and cement them to their proper positions on the fuselage.

LANDING-GEAR

Try constructing the landing-gear out of pine strips this time as a great deal of strength is obtained this way and there is very little difference in weight. For a flying model, rubber strand is wound where the thread is indicated on plate 5. This is exactly as the full size planes were and besides it gives a shock absorbing landing-gear that is very efficient. Cut a groove on the underside of the axle and cement a piece of No. 8 music wire in it. The wheels used are hardwood 1¾ inches in diameter. Put a washer on each side of them.

WINGS

You will find the wind rib pattern on the side view on plate 2. Make an aluminum template from it and trace off on 1/16-inch balsa sheet, 47 ribs and cut them out. Cut the left half of the wing diagram out of the plan and pin it in line with the right half that extends across the top of plates 4 and 5, then construct the top wing. Break it at points A-A for dihedral, which is ½-inch on each end. The two bottom halfs of the wing are constructed on the same wing diagram, only omit construction between points C-C.

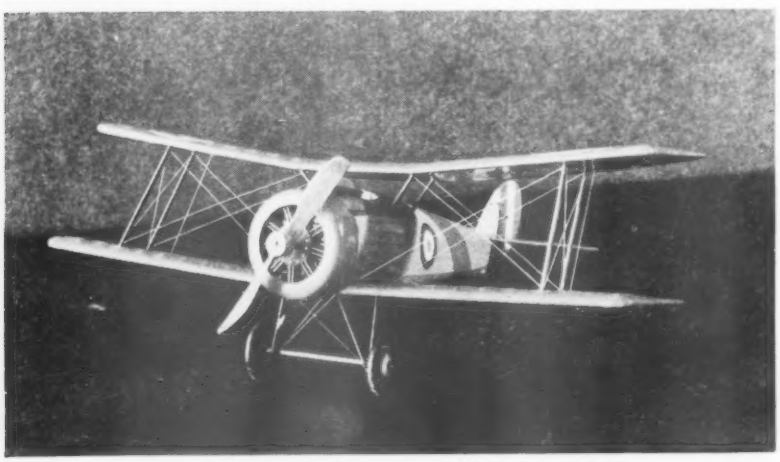
PAPERING

Now, paper the fuselage very carefully. Remember that it is sort of round and cannot be covered using one sheet of tissue. Cut small pieces and work around a little at a time joining each piece very carefully with the next. Cover the wings also at this time, pulling the tissue as tight as possible. Try using library paste to stick the tissue on with, it gives you more time to pull the wrinkles out and sticks as good as anything you are now using. Shrink the covering with water, give two coats of dope and one of gloss dope.

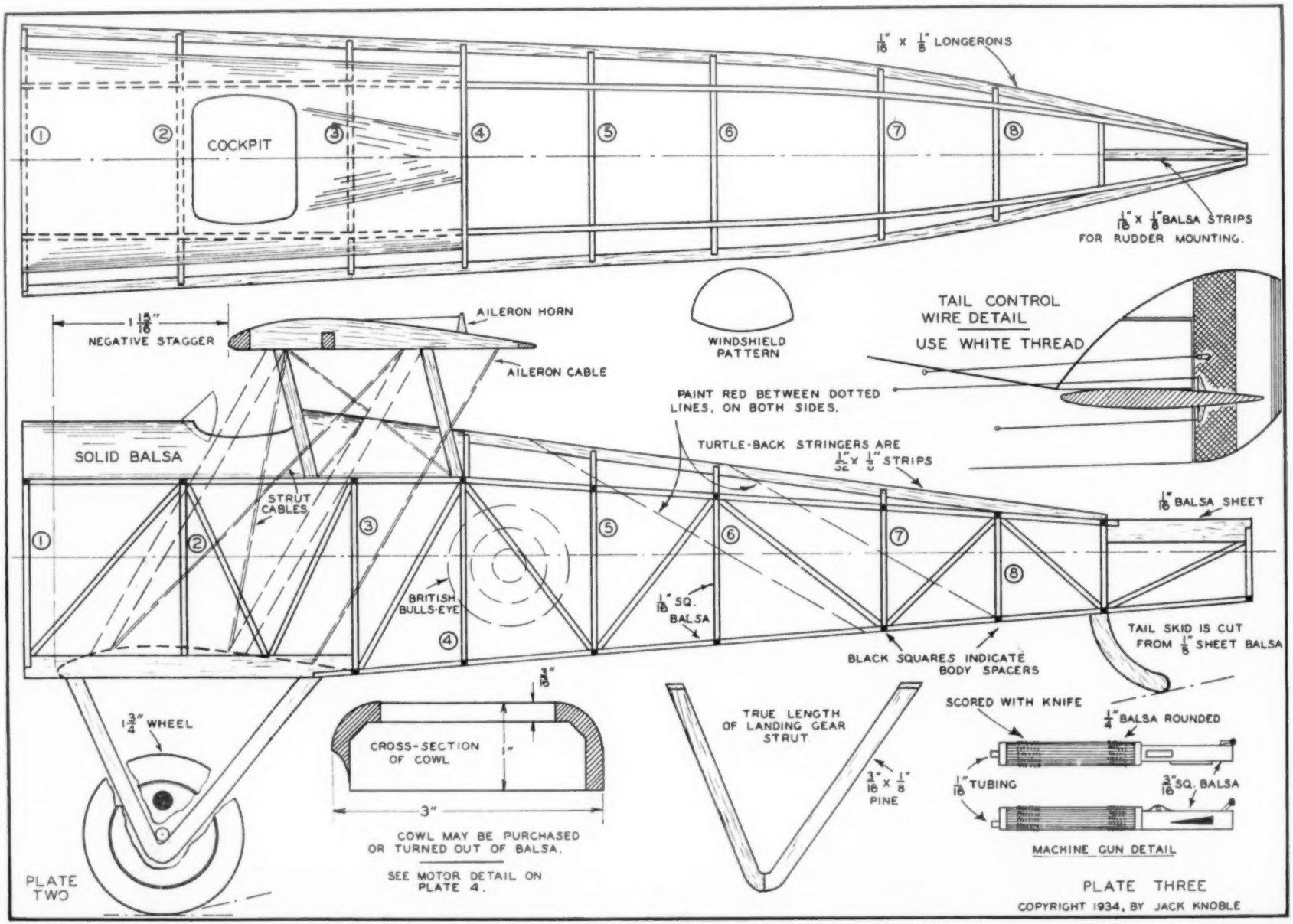
ASSEMBLY

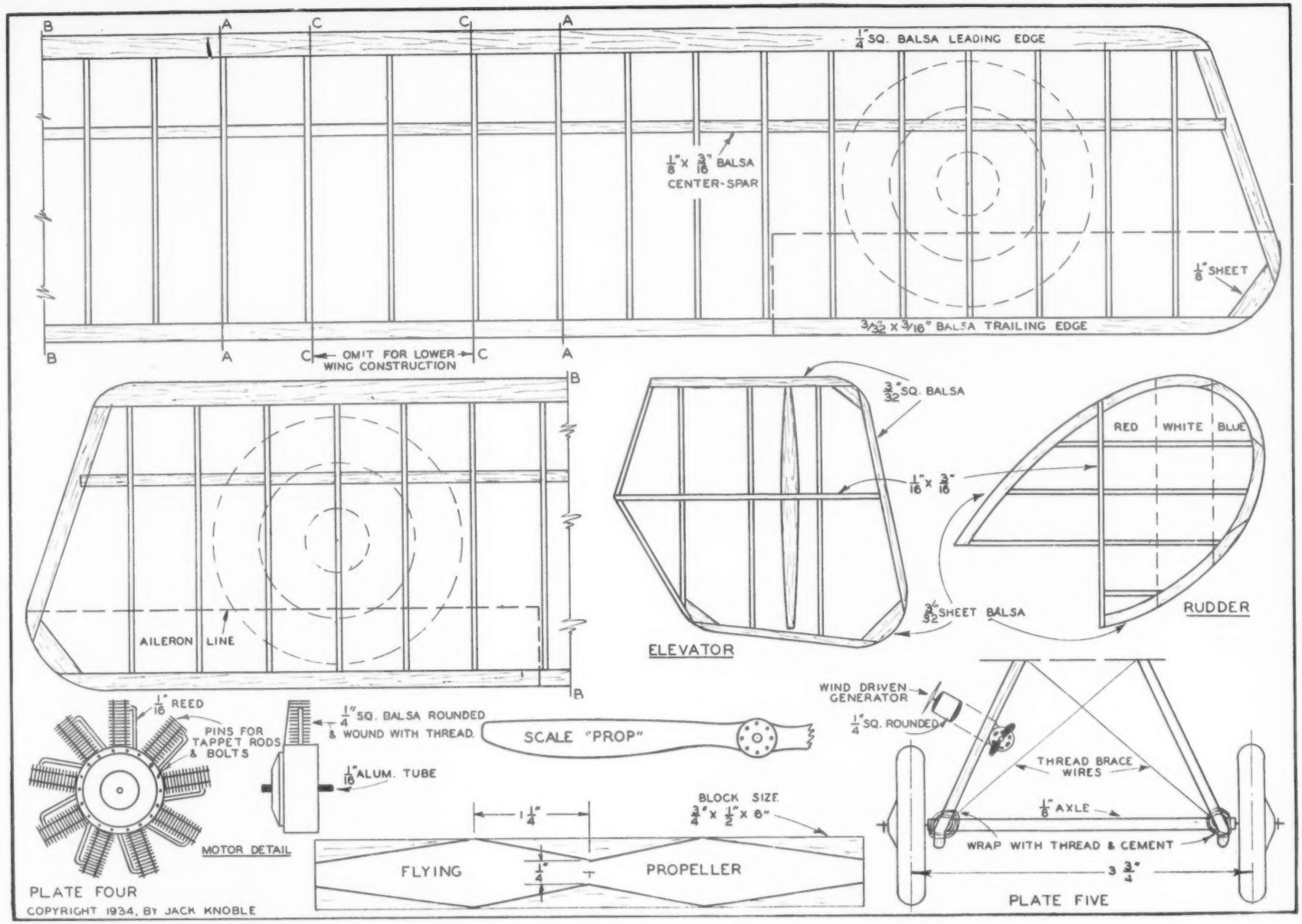
Cement the lower wings to the wing seats, blocking up the model and giving the wings their proper dihedral (½-inch) before the cement dries. When the lower wings have thoroughly dried in place cement the cabane struts to the fuselage and when they have

(Concluded on page 133)



Showing the interplane bracing arrangement of the deHaviland "5."


1/16" x 1/8" LONGERONS
COCKPIT
1/16" x 1/8" BALSA STRIPS FOR RUDDER MOUNTING.
1 15/16" NEGATIVE STAGGER
AILERON HORN
AILERON CABLE
WINDSHIELD PATTERN
TAIL CONTROL WIRE DETAIL
USE WHITE THREAD
PAINT RED BETWEEN DOTTED LINES, ON BOTH SIDES.
SOLID BALSA
STRUT CABLES
TURTLE-BACK STRINGERS ARE 1/32" X 1/8" STRIPS
1/16" BALSA SHEET
BRITISH BULLS-EYE
1/16" SQ. BALSA
BLACK SQUARES INDICATE BODY SPACERS
TAIL SKID IS CUT FROM 1/8" SHEET BALSA
1 3/4" WHEEL
CROSS-SECTION OF COWL
3/32"
1"
3"
COWL MAY BE PURCHASED OR TURNED OUT OF BALSA.
SEE MOTOR DETAIL ON PLATE 4.
TRUE LENGTH OF LANDING GEAR STRUT
3/16" X 1/8" PINE
SCORED WITH KNIFE
1/4" BALSA ROUNDED
1/16" TUBING
3/16" SQ. BALSA
MACHINE GUN DETAIL
PLATE TWO
PLATE THREE
COPYRIGHT 1934, BY JACK KNOBLE

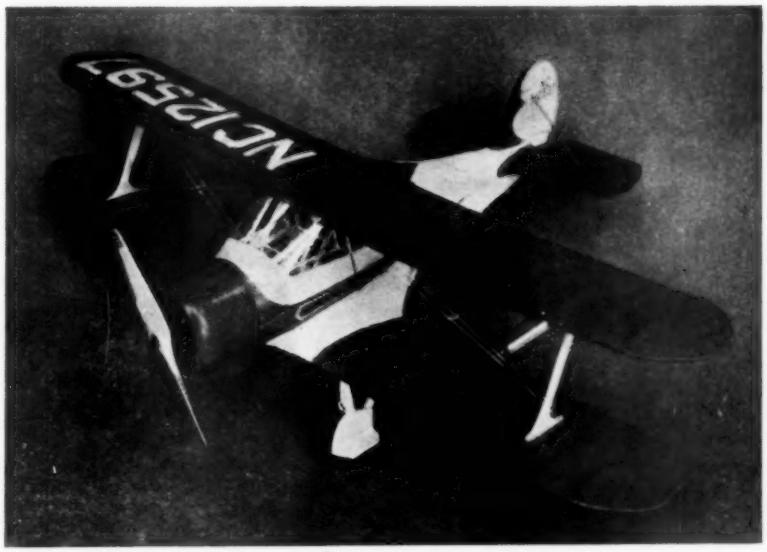

B
A
C
C
A
1/4" SQ. BALSA LEADING EDGE
1/8" x 3/16" BALSA CENTER-SPAR
1/8" SHEET
3/32" x 3/16" BALSA TRAILING EDGE
B
A
C
OMIT FOR LOWER WING CONSTRUCTION
C
A
B
AILERON LINE
B
3/32" SQ. BALSA
1/16" x 3/16"
3/32" SHEET BALSA
ELEVATOR
RED
WHITE
BLUE
RUDDER
1/16" REED
PINS FOR TAPPET RODS & BOLTS
MOTOR DETAIL
1/4" SQ. BALSA ROUNDED & WOUND WITH THREAD.
1/16" ALUM. TUBE
SCALE "PROP"
1 1/4"
BLOCK SIZE 3/4" x 1/2" x 6"
FLYING
1/4"
PROPELLER
PLATE FOUR
WIND DRIVEN GENERATOR
1/4" SQ. ROUNDED
THREAD BRACE WIRES
1/8" AXLE
WRAP WITH THREAD & CEMENT
3 3/4"
PLATE FIVE
COPYRIGHT 1934, BY JACK KNOBLE

Building the Beechcraft B-17L

by

PAUL W. LINDBERG

Model editor and designer for
POPULAR AVIATION.



This negatively staggered Beechcraft model is an exceptional flyer and good-looking, too.

AT last we have perfected an authentic flying scale model of the famous Beechcraft Model B-17L. Its flight will thrill you, because it takes to the air very gracefully, and the staggered arrangement of the wings gives it stability-plus.

All these fine qualities did not satisfy us, therefore, we decided to give you a real treat, a shock-absorbing system in the landing-gear struts which operates very much like those on the actual ship. Our laboratory is constantly working out new and improved features which we enjoy giving you with each issue of POPULAR AVIATION. All dimensions can be quickly and accurately determined by placing a ruler on the parts to be measured. If you wish a larger model, multiply this measurement by the amount of increase.

COLOR SCHEME

Cowl, wings, elevator, and trimmings, blue. Fuselage, rudder, and inner stripes on sides of fuselage, Diana cream. Details, black.

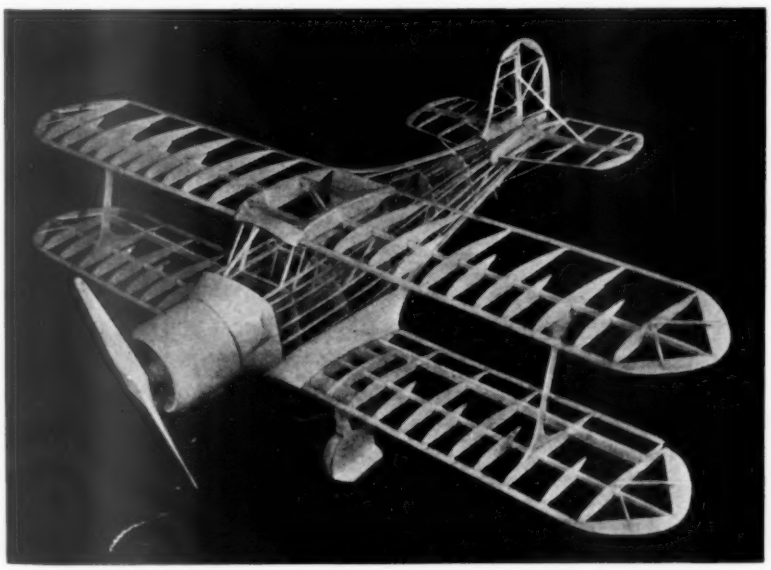
CONSTRUCTION OF FUSELAGE

First, place waxed paper on top of plan to prevent parts from sticking to plan. The fuselage sides are built from 1/16-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented by inserting straight pins on either side of strips wherever needed.

When the two sides are completed, the cross-members are cemented into their proper locations. Check carefully front to rear for alignment.

Cut the formers from 1/32-inch sheet balsa and cement in their respective positions as shown on the plan.

The positions of all stringers are clearly shown on the formers. Much time should be taken in fitting the curved 1/16-inch thick balsa pieces between top of the rear part of cabin and former F-3. Work stringers from front to rear. Four pieces of ⅛-inch thick balsa are cemented together shaped and fitted to front of fuselage as shown on plan. The front of cowl is of balsa, the back of stiff paper.



The frame of the Beechcraft model before covering, shows strength and simplicity.

CONSTRUCTION OF THE WINGS

Cut all ribs from 1/32-inch balsa. Pin center spar in position on the plan. Now, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs. The lower wing panels carry movable ailerons which are a great help in controlling the flights. Note, balsa supports in lower wing panels to receive front and rear struts. Diagonal strut at rear is hinged to fillet. Make wing tips from 1/16-inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

ELEVATOR AND RUDDER

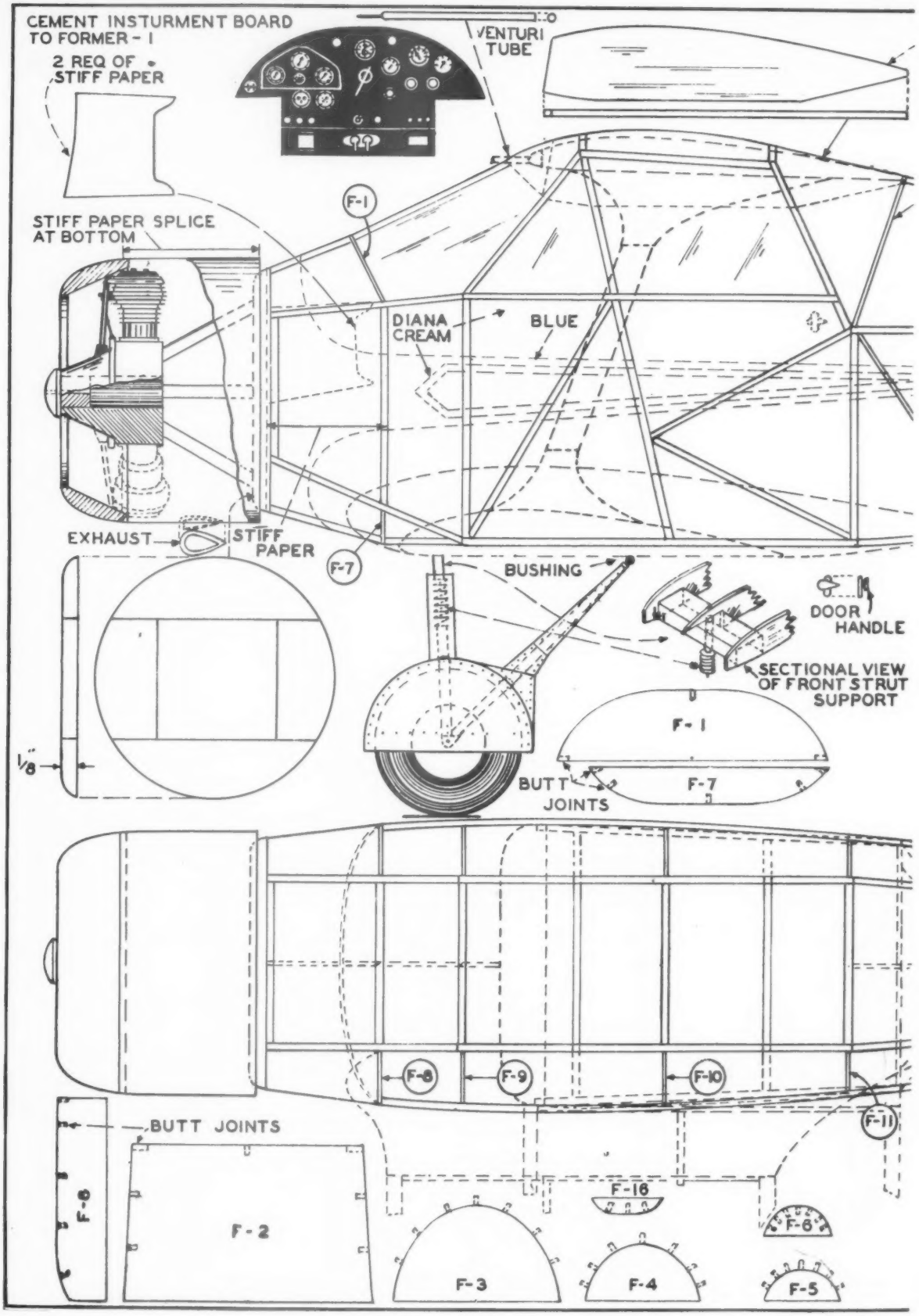
The rudder is built from 1/16-inch square and 1/16-inch flat for the curved edges. The braces are from 1/32-inch by 1/16-inch balsa. The elevator is streamline and requires a little more care in the construction. Fillets for the elevator and rudder are made from soft balsa.

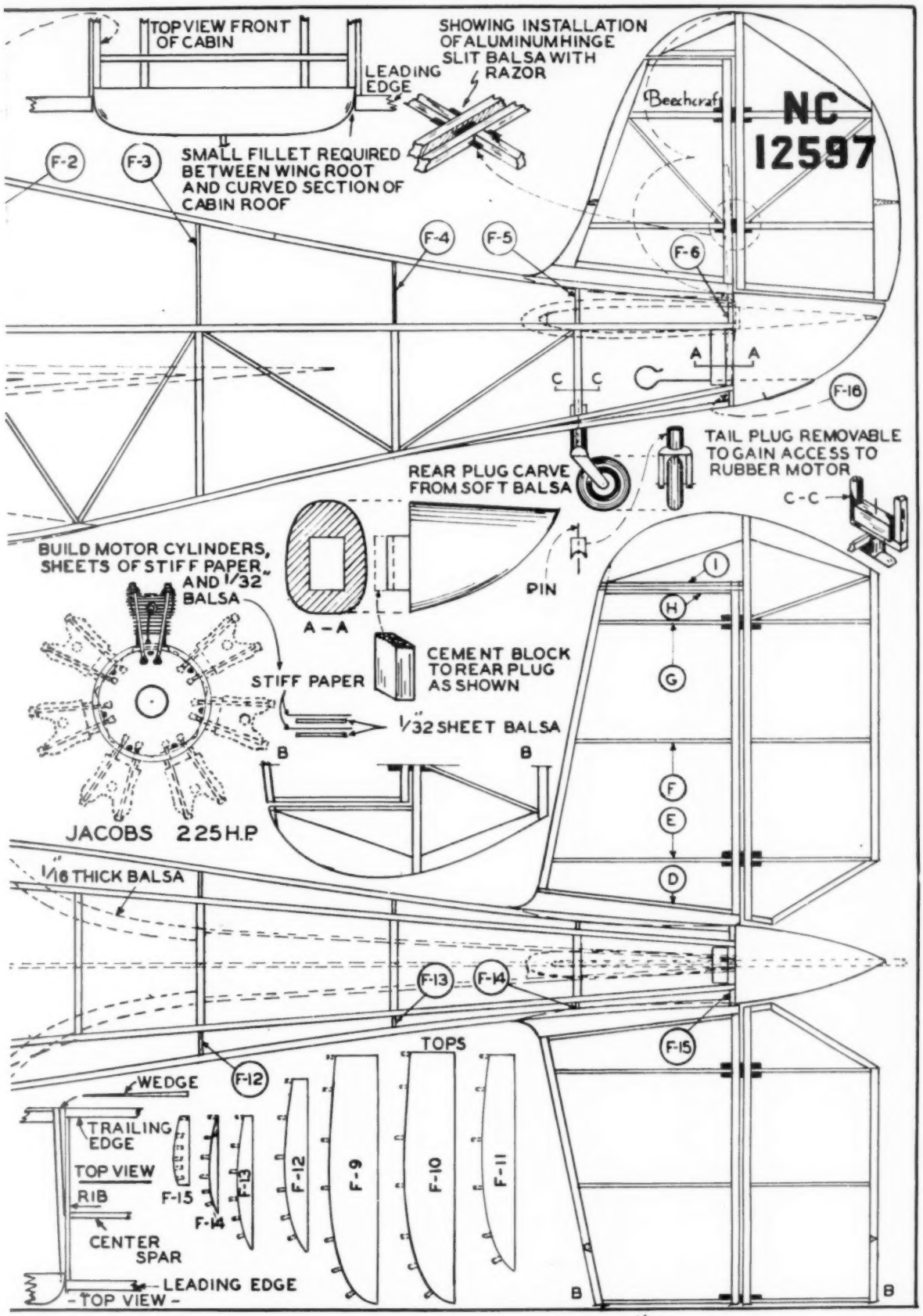
FILLETS FOR FUSELAGE

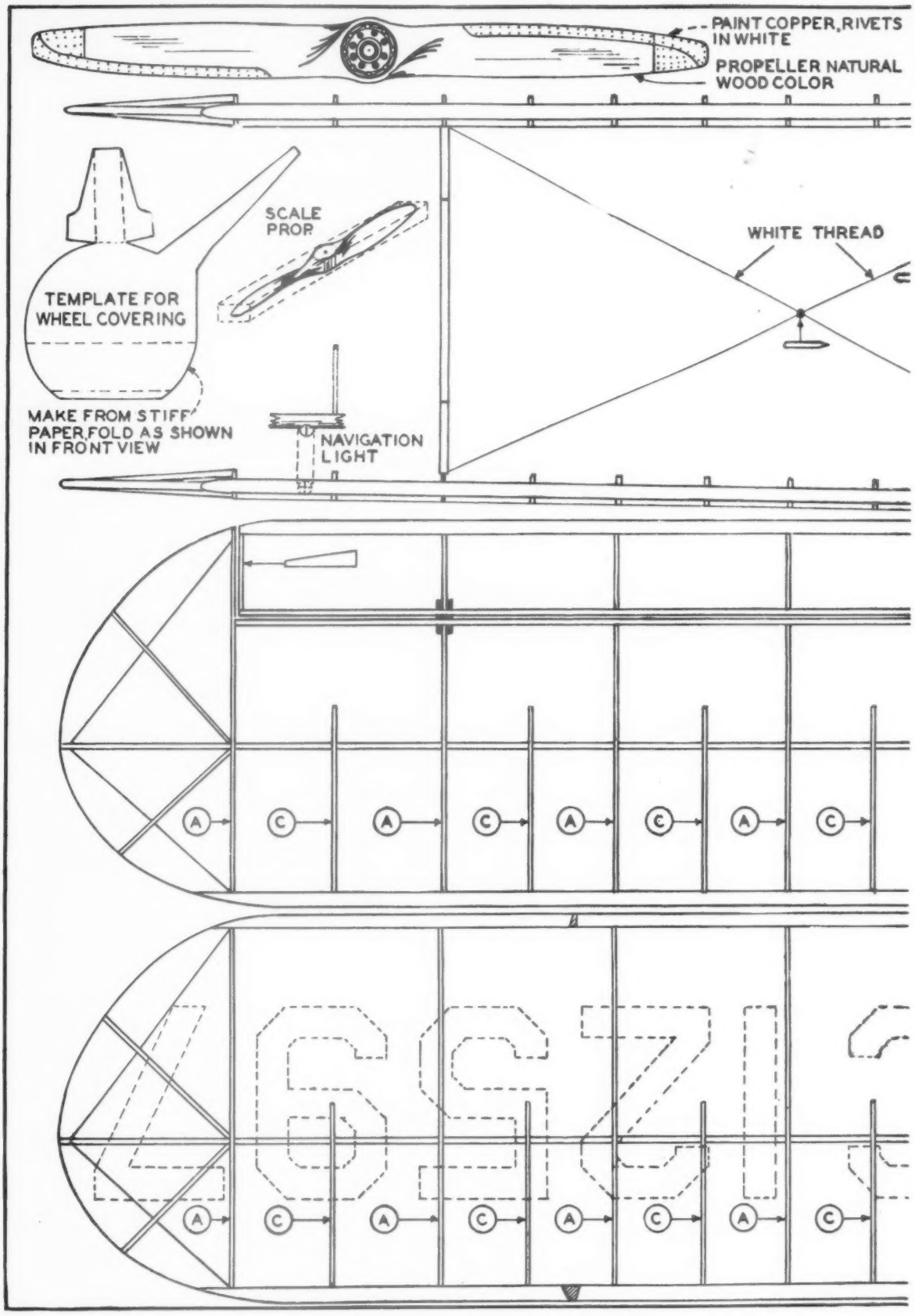
The fillets connecting the lower wing panels to the fuselage are carved and sanded from soft balsa. Great care should be taken when fitting the fillets to the fuselage so that you will have a perfect fit. Any openings along the edges may be sealed with strips of balsa and cement and sanded down for a smooth finish.

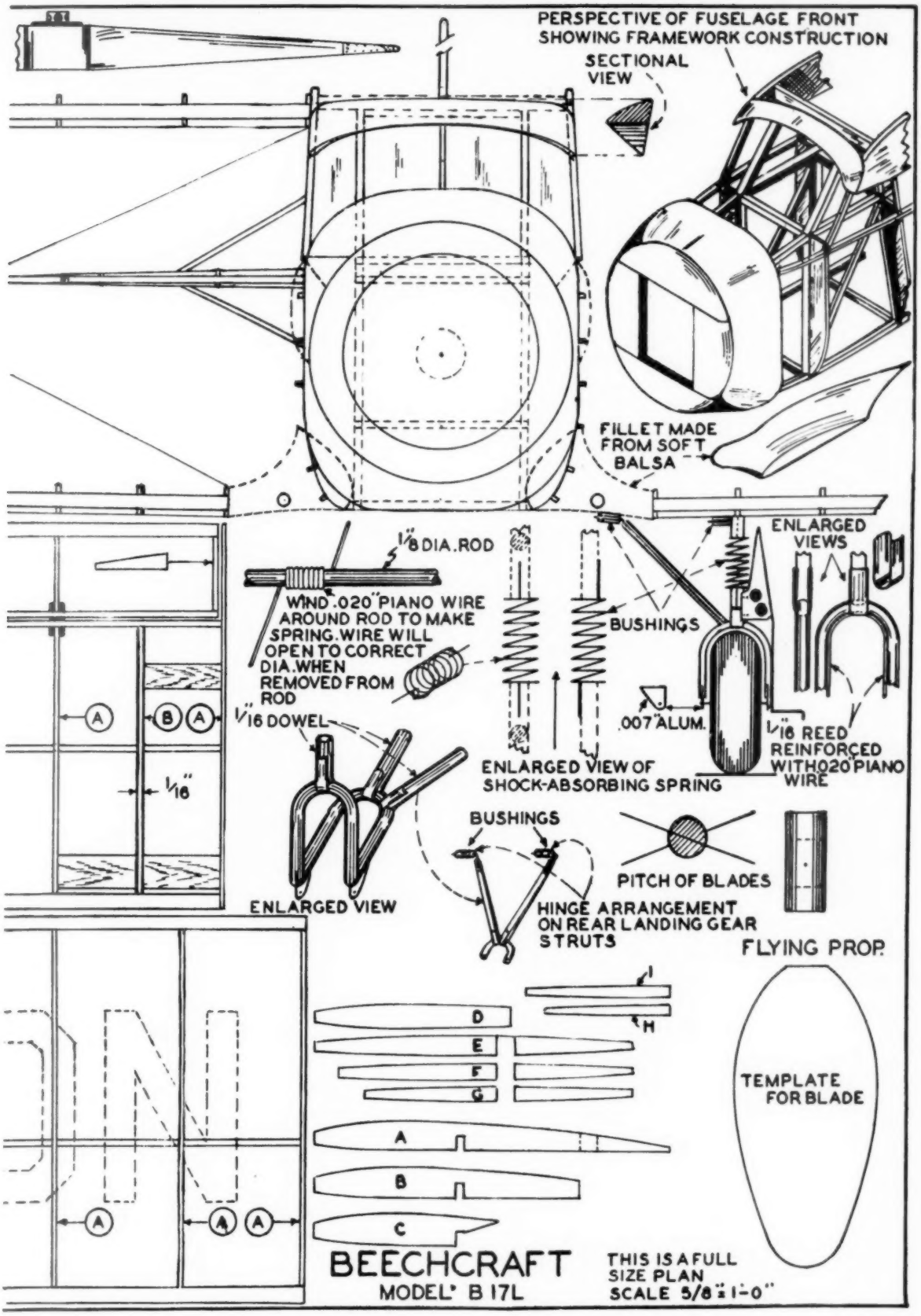
(Concluded on page 115)

COPYRIGHT 1934, BY JACK ARNOLD


CEMENT INSTURMENT BOARD TO FORMER - 1
2 REQ OF STIFF PAPER
VENTURI TUBE
STIFF PAPER SPLICE AT BOTTOM
F-1
DIANA CREAM
BLUE
EXHAUST
STIFF PAPER
F-7
BUSHING
DOOR HANDLE
SECTIONAL VIEW OF FRONT STRUT SUPPORT
1/8"
F-1
F-7
BUTT JOINTS
F-8
F-9
F-10
F-11
BUTT JOINTS
F-6
F-2
F-16
F-6
F-3
F-4
F-5


TOP VIEW FRONT OF CABIN
LEADING EDGE
SHOWING INSTALLATION OF ALUMINUM HINGE SLIT BALSA WITH RAZOR
Beechcraft
NC 12597
F-2
F-3
SMALL FILLET REQUIRED BETWEEN WING ROOT AND CURVED SECTION OF CABIN ROOF
F-4
F-5
F-6
A A
C C
F-16
TAIL PLUG REMOVABLE TO GAIN ACCESS TO RUBBER MOTOR
C-C
REAR PLUG CARVE FROM SOFT BALSA
PIN
BUILD MOTOR CYLINDERS, SHEETS OF STIFF PAPER AND 1/32" BALSA
A-A
CEMENT BLOCK TO REAR PLUG AS SHOWN
STIFF PAPER
1/32 SHEET BALSA
B B
JACOBS 225 H.P.
1/16 THICK BALSA
I
H
G
F
E
D
F-13
F-14
F-15
F-12
TOPS
WEDGE
TRAILING EDGE
TOP VIEW
RIB
CENTER SPAR
LEADING EDGE
- TOP VIEW -
F-9
F-10
F-11
B B


PAINT COPPER, RIVETS IN WHITE
PROPELLER NATURAL WOOD COLOR
SCALE PROP
WHITE THREAD
TEMPLATE FOR WHEEL COVERING
MAKE FROM STIFF PAPER, FOLD AS SHOWN IN FRONT VIEW
NAVIGATION LIGHT
A
C


PERSPECTIVE OF FUSELAGE FRONT SHOWING FRAMEWORK CONSTRUCTION
SECTIONAL VIEW
FILLET MADE FROM SOFT BALSA
1/8 DIA. ROD
WIND .020" PIANO WIRE AROUND ROD TO MAKE SPRING. WIRE WILL OPEN TO CORRECT DIA. WHEN REMOVED FROM ROD
BUSHINGS
ENLARGED VIEWS
1/16 DOWEL
.007" ALUM.
1/16 REED REINFORCED WITH .020 PIANO WIRE
ENLARGED VIEW OF SHOCK-ABSORBING SPRING
ENLARGED VIEW
BUSHINGS
PITCH OF BLADES
HINGE ARRANGEMENT ON REAR LANDING GEAR STRUTS
FLYING PROP.
TEMPLATE FOR BLADE
A
B
C
D
E
F
G
H
I
BEECHCRAFT
MODEL B 17L
THIS IS A FULL SIZE PLAN
SCALE 5/8" = 1'-0"

What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

CRUISAIRE AIRCRAFT CORP., Elmwood and Hertel Avenues, Buffalo, N. Y., has been capitalized for $100,000, an amount which will be increased when ready for large production. The plant is installed in the Atterbury Motor Company Building and the mock-up should be ready about January 1. The officers are: Earl W. Rearwin, Pres.; William A. Clare, Vice Pres.; James R. Spraker, Secy.-Treas.; Sidney P. Lyon, Designing Engineer; P. J. Evans, Publicity.

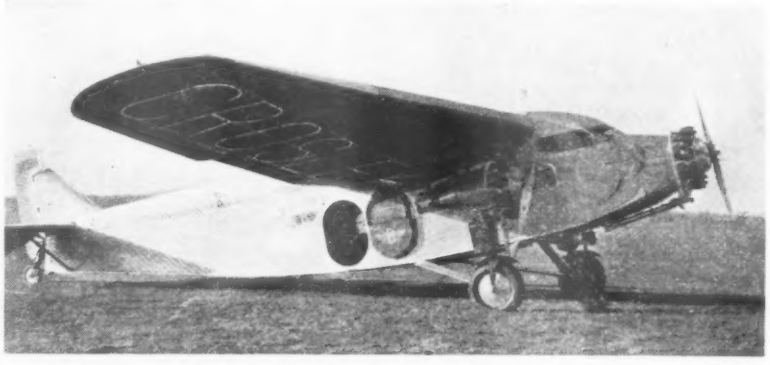
AIR TRANSPORT LINES operating in continental United States carried 48,477 passengers in October, 1934. These scheduled airlines flew 4,019,198 miles, carried 221,905 pounds of express, and flew 20,837,640 passenger-miles during October. There were 23 operating companies included in these figures. The passenger-miles flown in October, 1933, were 19,356,220.

WESTERN ELECTRIC COMPANY, 195 Broadway, New York, announces a new "one-conduction" type of radio headset. It weighs slightly over one-half ounce and is made of phenol-plastic material. This receiver, intended for transport pilots, is worn just back of the ear against the mastoid process, and has been designed to give a large area of contact with the head. The sound vibrations are transmitted to the bones of the head, thence to the inner ear. It has the advantage of leaving the ear open so that the ear can function as well as the receiver.

APPROVED Type Certificate has just been granted the Security National Aircraft Corporation, Van Nuys, Calif., on their new pontoon-equipped Security Airster, according to W. B. Kinner, president of the company. The new seaplane model is equipped with Edo pontoons and retains all of the features of the Airster landplane, including the patented folding wing. A fertile market for Security seaplanes is seen by the Scandinavian representative of the company, because of the scarcity of landing fields in his country.

OLIVER L. PARKS, President of Parks Air College, E. St. Louis, Ill., has been appointed a member of the Code Authority for commercial aviation. The duties of Mr. Parks will have to do with the administration of the Code in the aviation industry aside from military and scheduled air transport aviation.

AIR EXPRESS service was inaugurated to and from eleven New England cities served by the Boston-Maine Airways and Central Vermont Airways. Signing of contracts between Railway Express and the two railroad-operated airlines marks another step in the coordination of transportation facilities.



A tri-motor with neon tube letters on the wing is employed by the Crosley Radio Company for advertising its product. This method is meeting with great success according to Powell Crosley, president of the company.

A.B.C. FLYING SERVICE, INC., has entered actively into the business of serving the sportsman flyer at Roosevelt Field, Mineola, N. Y.

WALLACE BEERY, the celebrated movie actor, has traded in his present Bellanca Skyrocket on a new 1935 model of the Skyrocket. Mr. Beery's new plane will be the last word in airplane construction and will be equipped with the new 550 h.p. Series "H" Wasp engine.

WILLIAM STIEGLITZ and Bruce Smith, aeronautical engineers, Suite 312, Clark-Howard Building, Chicago, Ill., are prepared to furnish complete engineering service on the design, stress analysis, etc., of airplanes. They have had extensive experience in the design of lightplanes, and their services should be of value to those who wish to obtain an A.T.C.

BELIEVING that the science of meteorology can be greatly aided by photography, and thus guarantee the further security of its passengers, TWA, Inc., has announced that all of its pilots and copilots will hereafter be equipped with cameras so that they can shoot pictures of the clouds and other atmospheric phenomena observed during flight. At present, the texture of the underside of cloud layers is of great importance in weather prediction and photography of airline pilots will afford a convenient method of collecting such data. With TWA's 86 pilots on the job, meteorology will be greatly assisted.

THE ENTIRE first group of the new Ryan S-T low-wing monoplanes has been sold in advance of production, according to Earl D. Prudden, vice president of the Ryan Aeronautical Company.

PALMER NICHOLLS, who has been vice president and general manager of Pacific Airmotive, Inc., since its inception in 1927, is assuming the presidency of the company, following the death of W. E. "Tommy" Thomas. Pacific Airmotive, Inc., with headquarters at Union Air Terminal, Los Angeles, Calif., carries a stock of replacement parts for every make and type of airplane, besides being West Coast distributors for all major aviation motors, including Pratt & Whitney, Wright, Kinner, Continental, Lambert, and Jacobs.

STONHARD COMPANY, 401 N. Broad Street, Philadelphia, Pa., has perfected a surface hardening treatment for concrete floors that possesses many advantages over methods formerly used. Stonhard Concrete Surface Treatment not only penetrates concrete floor surfaces to weld the cement and aggregate into a solid mass, but it also is a vehicle for a solid that seals and fills the surface pores.

EASTERN AIR LINES is the latest transport line to adopt Western Electric Radiophones as standard equipment. This radio apparatus has recently been put into service on the five Douglas planes known as the "Florida Flyers" on the speedy Miami route. Four more Douglas planes on the Eastern Air Lines are being similarly equipped.

FREQUENT business trips are made in the Lockheed Vega plane owned and used for the transportation of officials of The General Tire and Rubber Company. This plane, which is in charge of Ray W. Brown, former Army Air Corps officer and head of aeronautical tire sales for the company, has a speed of 180 m.p.h.

A FORD tri-motor, owned by the Brand Aviation Corporation, Columbus, Ohio, is employed by the Crosley Radio Corporation for advertising purposes and for transporting its guests between their homes and the Crosley factory. Under each wing is a big neon sign with letters eight feet high while under the body is a bank of incandescent lamps with more than 300 electric light bulbs. The bulbs are operated from a typewriter arrangement so that any letter of the alphabet can be lighted by pressing the proper key. This advertising is said to be very effective and the means of closing up several big accounts.

AVIATION has brought Key West, Florida, within a little more than one hour's travel from Miami by a service recently inaugurated. A 16-passenger Commodore seaplane is operated on the system.

This is the Corben "Baby Ace" that has been doing good work for POPULAR AVIATION. The sign, "Read POPULAR AVIATION" on the side of the ship has been read by tens of thousands.

Beechcraft Model

(Continued from page 109)

MOTOR

The motor cylinders are built up from sheets of stiff paper and balsa cut into discs to represent the fins, etc. When the motor is complete, it is attached to front of fuselage by ⅛-inch square motor-mount braces.

LANDING-GEAR

We have gone into a great amount of detail in drawing the different views on the plan, and we believe you should have no difficulty here. Study details carefully.

COVERING THE MODEL

Apply tissue to the various framework members, using a light grade of model-airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator, and such upon a flat surface to keep from warping.

Next, apply a coat of clear dope to all surfaces. Now apply colored dopes. Note, do not try to cover frame when it is completely assembled. Wings, elevators, etc., are cemented to fuselage after they have been completely covered with tissue.

ASSEMBLY

The wings, elevator, rudder, landing-gear, etc., can now be cemented in their correct positions. The elevator is braced with four struts, two running on either side of the fuselage outward to the elevator. The rudder is braced with two struts, one running downward on either side to the elevator.

The flying and landing wires are made with a threaded needle which you force through the balsa. Cement thread in place with a drop of cement. Identification numbers are cut from white paper and doped to upper and lower wing panels. The windows on either side are cut from one piece to fit from rear to former 9.

The curved windshield is cut from one piece working from former 9 to former 9. All other small details are clearly explained on the plan. Two types of propellers are shown on the plan. The flying propeller, which has fiber blades, has less r.p.m. in order that the model can fly a greater distance. Plenty of patience is required to construct the propeller. It should be carefully adjusted until the best results are obtained.

Four to six strands of ⅛-inch flat rubber are sufficient to fly the model. To balance the model, a small amount of weight can be added to the nose.

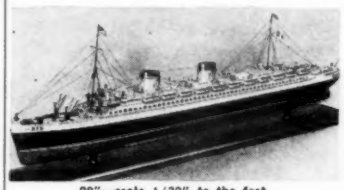
NOTE! Mr. P. W. Lindberg would appreciate it very much if readers of POPULAR AVIATION *would write him just what models they would like him to design. Address: Model Editor,* POPULAR AVIATION, *608 S. Dearborn St., Chicago, Ill.*

END

LEARN AVIATION

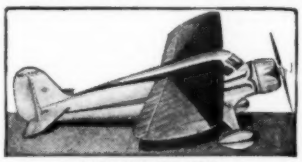
By building these beautiful Super-Detail Flying Planes . . . designed by flying men . . . in exact scale.

Another NEW Super-Detail model . . . the Italian liner REX.



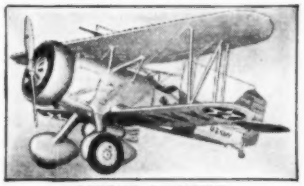
29"—scale 1/32" to the foot.

Shaped hull and over 100 metal fittings. 24 cast metal lifeboats; 24 cast stairways, 2 cast anchors; 4 metal propellers; 6 cast bits; 48 metal davits. The Rex comes in beautiful high luster original colors of black, orange, white, red and green; and the kit also contains turned wood parts, printed wood, cement, wood filler sandpaper, etc. Full sized plans with complete instructions and 7 photographs illustrating the different stages of construction. All the hard work has been done for you.
Kit complete, postpaid.....$6.00



STINSON RELIANT

Wingspan 32 5/16", length 21¼", weight 3½ oz., exact ¾" scale. Adjustable speed arresters built into the wings, the movable cabin doors, the complete interior with four seats and control column, and all the other Super-Detail features. Colored in bright contrasting yellow and black. **Kit complete, postpaid.....$2.50**

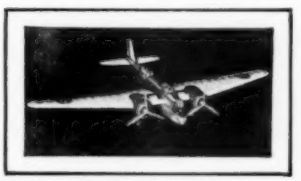


CURTISS GOSHAWK

Wingspan 23⅜", length 16¾", weight 3⅛ oz., exact ¾" scale. Coated with the new IDEAL high lustre finish, with silver, yellow, red and black coloring. **Kit complete, postpaid.....$2.00**

BOEING P-26A

Wingspan 21¼", length 18", weight 2½ oz., Exact ¾" scale. This flying model is an exact replica of the famous fighter—one that is identical in all but size with its noteworthy big brother. Beautifully colored in olive drab and yellow. All Super-Detail parts included. **Kit complete, postpaid.....$1.75**



MARTIN BOMBER

Wingspan 35", length 22½", weight 4⅝ oz. Exact scale. Retractable landing gear, rotating gun turret, movable machine guns, special streamline cowlings, two types of 3 bladed propellers—one for flying and one for exhibition with removable motor sticks for flying; rudder and elevator balanced surfaces; new type freese ailerons.
Kit complete, postpaid.....$3.50

"These IDEAL Super-Detail Planes are beauties Dad."

"Yes Son, they're true quality kits."

The Ideal Super-Detail Planes are true quality planes unlike any other on the market, and with entirely new and exclusive features designed by practical flying men and beautifully constructed to give you a perfect flying job. You can rest assured when you buy a Super-Detail plane that you are getting the finest plane it is possible to buy for the money.

For example you can operate controls from the cockpit just as you do in the big planes. There are the bright high lustre finish—pulleys—control horns—control cables—streamline drag rings—exact scale wood wheels—everything an exact duplicate of the big planes and exclusive with Ideal.

That is why you really learn the principles of aviation when you build planes the Ideal way; why they are exact reproductions perfect in every detail; why the experienced prize winning model builders prefer Super-Detail kits.

Send the coupon today for any of the kits pictured. Everything necessary to build a big beautiful workmanlike flying job is included. You only have to follow the complete and simple instructions to obtain extraordinary results.

ILLUSTRATED FOLDER **Send 3c for the new IDEAL folder showing the latest model IDEAL Planes. It contains valuable information on how you can make real money by building and selling these famous flying models.**

DEALERS: You can make more money with IDEAL products. Write for details of more than 100 model airplanes & ship models.

IDEAL AEROPLANE & SUPPLY CO., INC.

22-26 West 19th Street, New York, N. Y.

Pacific Branch:
Model Boat & Aircraft Co., 1356 Fifth Ave., San Diego, Calif.
Canadian Branch:
Canadian Model Aircraft, 3007 St. Antoine Street, Montreal.

See your local dealer or send the coupon

IDEAL AEROPLANE & SUPPLY CO., INC.
22-26 W. 19th St., New York City.
Please send the items I have checked. I am enclosing $..... (West of Denver 25c extra. All planes postpaid.) Canadian Prices 40% higher to cover duty.

Martin Bomber ☐ $3.50 **Curtis Goshawk ☐ $2.00**
Boeing P-26A ☐ $1.75 **Rex ☐ $6.00**
Stinson Reliant Airliner ☐ $2.50
Folder with information ☐ 3c

Please print name.....
Address.....
City..... State.....

PUBLIC LIBRARY DEPARTMENT OF TECHNOLOGY

576 PAGES
Crammed full

News, pictures, drawings, plans, valuable advance data, authentic facts, complete details of what's doing in the Model Airplane Industry. A volume of material you will want to read and save—all of this contained in a

12 MONTH SUBSCRIPTION TO

UNIVERSAL MODEL AIRPLANE NEWS

"THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO EXPERIMENTAL AVIATION"

Don't put it off any longer. To miss one month is to pass up some essential information that you will want to know. Subscribe now to the publication that *every* model builder recognizes as the oldest authentic source of information in the model field.

—and it's all yours for $1.65

and here's what you get besides:

These 2 Kits FREE!

Complete! Ready to Build!

(At left)—the well-known S.P.A.D.
(Below)—War fighter NIEUPORT

Regular 75c value. Complete with correct insignia, lacquer, metal props, balsa, dope and plans to build **BOTH MODELS.**

Two kits for you to build lifelike models of the famous war-time Spad and Nieuport. They have been reproduced in ¼" scale and will provide great enjoyment to old and young model builders alike. Both kits are sent free with every subscription.

This liberal offer expires February 5th, 1935

MAIL THIS COUPON NOW!

JAY PUBLISHING CORP. PA-2
551 Fifth Avenue, Desk 425
New York City

Enclosed find $1.65 for which please send to the address below, UNIVERSAL MODEL AIRPLANE NEWS for one year, together with the S.P.A.D. and NIEUPORT Construction Kits absolutely FREE.

Name.....

Age.....

Street.....

City..... State.....

Propellers

(Continued from page 86)

The rate at which the material is conveyed by the screw is not uniform throughout the cross-section of the conveyor. Frictional resistance between the wall of the cylinder and the material will retard its free flow so that the velocity of the material would be greatest at some point between the periphery of the screw and the shaft, the outer region of the screw being therefore less effective.

In the case of a fast-turning screw, considerable internal friction of the material would necessitate the application of a force in excess of what would be ideally required; eddying and churning of the material would be another detrimental factor to be considered.

The example of the screw-conveyor may seem irrelevant and far-fetched; yet a little reflection will show its analogy with the aircraft propeller.

The material represents the air as it is sucked into the propeller, and corresponds to the *inflow*, whereas the material as it leaves the screw corresponds to the *outflow*. The pressure against the end plate corresponds to the thrust of the propeller, this thrust being necessary to overcome the forward resistance of the aircraft as represented by the weight (1).

The forward speed of the cylinder with reference to the ground represents the speed of the plane relative to the air, while the turning moment of the force applied at the crank represents the torque of the engine.

With a very rapidly turning screw the same propelling effect can be obtained in a very fluid medium, such as air, by using only narrow sectors of the same screw blade, as indicated by the dotted lines in Figure 1. Since these sectors are radially opposed to each other, they are, of course, spaced apart a distance of half the pitch; by bringing both sectors however in diametral alignment the arrangement resembles the airscrew, or water screw, of the conventional type. The number of blades is, of course, not confined to two, and three or four may be used, equally spaced angularly, if a reduction in diameter is desired.

The forward speed of the propeller parallel to its axis of rotation is called *the translational speed*, while the speed at which it rotates about its axis is called the *rotational speed*.

If the propeller rotates at N revolutions per minute, the time required for one revolution will be 1/N minutes of 60/N seconds. If the aircraft has a forward speed of V feet per minute, the advance made during one revolution of the propeller then is V/N feet. This is called the *effective pitch* of the propeller.

Any point of the propeller blade describes *a helix* during its forward advance, and since this forward advance is, of course, the same for all points, the *angle of helix* will be different for points situated at different distances from the center of the propeller.

To get the least angle of helix we have to unroll the circle and helix swept by the tips of the propeller, which gives us the triangle shown in Figure 2. If D is the diameter of the propeller in feet, the circumference of the circle is 3.14 D. = D^1. This quantity is laid off as the vertical side of the triangle, while the advance per revolution is the horizontal side of the triangle. The pitch angle a then is determined by the ratio V/N divided by D^1, which is equal to V/ND^1. = tangent a.

The quantities V and N are variables of performance, whereas the quantity

A NEW DEAL IN AVIATION

For the THOUSANDS of young men who would like to learn to FLY, but the cost has been too high, we have a club FINANCE plan whereby they can purchase a

STABLE COMFORTABLE MANEUVERABLE

WELCH AIRPLANE for $795.00 and up

RUGGED SIMPLIFIED ECONOMICAL

With payments of $10.00 per Month. For complete details how to organize a Club, send 25c in Coin or Stamps.

WELCH AIRPLANES, 1406 Meredian St., ANDERSON, INDIANA

D is fixed. The propeller characteristics therefore not only depend upon the absolute values of V and N, but also upon their relative values.

It should be noted that the effective pitch alone does not give a definite idea of the speed of the plane or of the r.p.m. of the propeller, since the same value for V/N can be obtained for different conditions.

For instance, in a plane having a forward speed of 150 m.p.h. or 13,200 feet per minute at 2,200 r.p.m., the propeller will have an effective pitch of 6 feet. This same pitch holds good for a plane traveling 75 m.p.h. at 1,100 revolutions. The two propellers, however, will differ in diameter and in other respects.

Where expressed in terms of V, N and D, the propeller characteristics are easily grasped by the pilot, since these quantities are known to him by his air speed and revolution indicators, and are moreover under his control, whereas other quantities such as pitch angle, incidence angle of blade, or slip are only indirectly known to him.

We wish to point out that there is no royal road to propeller designing; those who wish to take it up will have to familiarize themselves with various propeller theories and with the experimental data made available by many years of experimental research.

The subject is of too wide a scope to be treated thoroughly in a few paragraphs and we must confine ourselves to presenting such simple data and working formulae as will enable the prospective designer to obtain an approximate idea of what his propeller will do.

There are two methods of calculating a propeller: the blade-element method, and the momentum method. Of these two, the *blade-element theory* seems to be the more popular and will therefore be explained in detail hereinafter. The *momentum theory* is based on the acceleration and mass of the air thrown back by the propeller. Each method has its advantages and drawbacks.

The blade-element theory was originally called the DRZWIECKY theory after its originator. The propeller blade is considered as a series of wing sections, each having its own characteristics as to lift, drag and L/D. The cross-sectional profile, of course, varies from tip to root of the blade and the required aerodynamical data for each airfoil must be available. These sections are considered in lengths of say, six inches each, and the components for thrust and torque (corresponding to lift and drag) are then computed.

The thrusts can then be plotted against the corresponding radii of the blade, and another graph should be prepared showing the torque or horsepower absorbed likewise plotted against the radii.

The integration of each of these curves gives the total power absorbed and the total thrust delivered by the propeller.

The horsepower delivered by the pro-

Regular Pilot Albert Ball (United Air Lines) gives his views of training schools

"Since I graduated from Boeing_"

"I've seen too many men with a pretty diploma trying to land jobs that required a background they just didn't have," wrote Albert Ball to a younger friend recently. "My advice to you is choose a conservative school like Boeing — where, besides flying, they give you plenty of hours of 'practical' and 'theoretical'."

We reproduce this comment because it expresses so aptly the viewpoints of United Air Lines and of Boeing School itself. Any Boeing graduate will agree that the courses here are much more comprehensive than those usually offered.

For example, the Boeing Airline Pilot and Operations course comprises 4015 hours of solid work. Lecture and shop, apprentice work, airline operations, dual and solo flying in 11 different types of planes . . . a concentration of experience few men in the industry get even from a lifetime of practical work.

If you are willing to grind in order to attain a worthwhile career in aviation, write today for further information about Boeing School and enrollment requirements. Rates from $700.00 upwards; courses from nine months to two years. Mail coupon today.

Boeing School of Aeronautics
Division of United Air Lines

"How to decide on your Aviation School"

W. D. Williams, Pilot Midwest Division, United Air Lines, lists 7 vital points to investigate:

- Has it a "playboy flying school" reputation — or is it known for its hard work?
- What equipment will I *actually* work with — in planes, laboratories, shops?
- Who are the men I will *actually* study under?
- Has school advantage of direct association with a large airline?
- What are its graduates doing?
- How does the U. S. Govt. rate it?
- Are students lured by promises of jobs; or are they attracted by the school's superior training?

NEXT REGULAR ENROLLMENT APRIL 1

Boeing School of Aeronautics, Dept. C-2, Airport, Oakland, California
Gentlemen: I am interested in the courses indicated:

☐ Boeing Airline Pilot
☐ Transport Pilot
☐ Limited Com'l Pilot
☐ Private Pilot
☐ Airline Mechanic
☐ Airline Operations
☐ Airline Technician (Open to Engineering graduates)
☐ Airline Pilot and Operations
☐ Special Airline Pilot (For Transport Pilots only)
☐ Amateur Pilot

Name _____ Age _____
Years in High School _____ Years in College _____
Address _____ Phone _____
City _____ State _____

BUFFALO ENGINEERING LIBRARY, TECHNOLOGY DEPARTMENT

peller divided by the brake-horsepower of the engine (in case of a direct drive; if a reduction gearing is interposed the brake-horsepower should be modified according to the frictional losses) gives the *efficiency* of the propeller.

The horsepower delivered by the propeller is found by multiplying the total thrust by the airplane speed in feet per second and dividing by 550.

The Drzwiecky method has the disadvantage of giving efficiencies which are far too high, since the effect of the *slipstream* has not been considered. By slipstream is meant the column of air thrown back by the propeller. Strictly speaking the air is already accelerated *in front* of the propeller, so that *the translational speed of the propeller with reference to the slipstream is greater than with reference to the surrounding air*, and the pitch of the propeller should therefore be calculated accordingly. This will give the *true effective pitch*. Shown in Figure 2.

It is not an easy matter to calculate the exact velocity of the slipstream. The air is sucked into the propeller funnelwise and is thrown back in a disturbed condition.

The following empirical working formula will give the component velocity of the slipstream (that is, the actual velocity of the slipstream, minus the translational velocity of the propeller) fairly accurately.

$$T = \frac{w}{g} A V_1 v$$

or more strictly $T = \frac{w}{g} A\ (V_1 + v)\ V_1$

in which

T = Thrust of propeller in lbs.

w/g = Weight of one cubic foot of air divided by acceleration due to gravity.

A = Area of the slipstream in sq. ft.

V_1 = The forward speed of the airplane in feet per second.

v = The *component* velocity of the slipstream.

The thrust T, we have seen, is equal to the product of the brake-horsepower of the engine times efficiency of propeller times 550, divided by the velocity of the plane in feet per second, or

$$T = \frac{\text{B.H.P. x e x 550}}{\text{V feet per second}}$$

Attention is drawn to the fact that V is expressed in feet per second. A speed of one mile per hour would be equivalent to 1,466 feet per second.

The true area of the slipstream is not easily determined, since it may be greatly affected by the tip speed of the blades. Excessive tip speed may create a vortex action which will restrict the effective disc area of the propeller. Interference of the propeller blades may also affect the disc area.

For practical purposes, however, the following formula will give good results:

$$A = \frac{3.14}{4}[D^2 - (D/5)^2]$$

in which D is the diameter of the propeller in feet.

The suctional action (inflow) in front of the propeller has been found to accelerate the air faster than the compressive action (outflow) behind the propeller and for purposes of calculation it may be assumed that 2/3 of the velocity of the slipstream occurs in front of the propeller; the pitch then should be figured for the translational speed of the airplane plus 2/3 the component velocity of the slipstream.

This velocity as we have seen is

NEW LOCKHEED P23 ARMY PURSUIT

Combination Land and Seaplane Set with Floats

32" Span, Length 22½", Weight 3¼ oz., ¾" Scale Model

One of the most outstanding values in models; it has excellent lifting power, rising from land or water in a few feet. From the latest Army land plane it is convertible into Lindbergh's seaplane by attaching the floats, material for which is in the set. Construction set contains: formers, ribs and pontoon parts printed on balsa, turned cowl front, celluloid wheels, axles, colored insignias, U. S. Army lettering, semi-scale propeller, yellow and drab dope, glue, 33"x44" full scale drawing, etc. Construction Set Complete, postpaid..... **$2.75**

NEW CURTISS HAWK F11C4

28" Span, Length 20½", Weight 3¾ oz., Flies 1,050 feet

Color: All Silver, Top-wing Yellow, Red Stripeing

A special de luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 700 h.p. type, Wright Cyclone motor, having aluminum push rods, cylinder finns, etc., like real motor, also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, pilots seat, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope paint, glue, red stripeing, Navy lettering, formed wire parts, axles, rubber motor, windshield, instrument board, flying wires; all parts, formers, wing ribs, wheel parts, etc., printed on balsa. Scale 1" to the foot, detail drawing. This model has movable ailerons, tail and rudder. Set comes in attractive gift box complete. Construction Set, postpaid..... **$4.50**

NEW LAIRD SUPER-RACER

18" Span, Length 15", Weight 2 oz.

A fast flying powerful looking model to exact scale, a de luxe model with 3⅜" turned motor front, bearing button with bearing, all parts printed on balsa, yellow and green dope, glue, aluminum wheels, formed wire parts, rubber, flying wires, detailed drawing. Construction Set, postpaid..... **$2.00**

NEW NORTHROP FTI NAVY FIGHTER

22" Span, Length 14½", Weight 2½ oz.

An exact ¾" scale flying model of the Navy's and world's fastest fighter, 272 m.p.h. Unequalled for detail, set contains all parts printed on balsa, special removable motor box, 3" turned cowl front, windshields, colored insignias, formed wire parts, instrument board, radio mast, silver dope, glue, drawing, etc. Construction Set, postpaid..... **$2.00**

24" Span, Flies 800 feet.

CURTISS HAWK P6E

All parts printed on balsa, colored dopes, glue, drawing, etc. Set postpaid. **$2.50**

BOEING F4B4 NAVY FIGHTER

22½" Span, Weight [illegible] oz. Length 14½", Silver Color

New improved model with 3¼" streamline tapered aluminum cowl, 8" carved scale flying propeller, ribs, formers, etc. Printed on balsa. Set P.P.. **$2.95**

MODEL GAS AND AIR MOTORS

Send 3c stamp for illustrated catalog Showing Gas Driven Models, Other Scale Models.

MINIATURE AIRCRAFT CORP.

83 Low Terrace **New Brighton, New York**

$$v = T : \left(\frac{w}{g} A V_1\right)$$

And two-thirds of this velocity is then added to the airplane speed.

The true effective pitch angle of any section of the propeller blade then is given by

Tangent f = (V₁ + 2/3 v) : V.

Where

f = True effective pitch angle of section.

V = 2 x 3.14 x r x n = rotational velocity of section in feet per second.

r = Radius at which section is taken.

n = Revolutions of propeller per second.

V₁ = Speed of airplane per second.

v = Component velocity of the slipstream.

After the true effective pitch angles have been found for the respective sections, the angle of attack for each section can then be selected, and the corresponding values of lift and drag can be taken from the L/D curve of that particular section. It is, of course, necessary to have all this data at hand, for the blade-element method cannot be applied without it.

The process can be shortened by computing the efficiency for a single representative section taken at ¾ radius. This will give a fairly average value. The aerodynamic characteristics of the various sections are, of course, different for each section and it is advisable to select a representative profile of known characteristics at the ¾ radius station. The slipstream efficiency at this point is

$$\frac{V}{V_1 + \frac{2v}{3}}$$

The airfoil efficiency is tan. (b-a), tan. a, (see Fig. 3), and the true efficiency is the product of both.

$$e = \text{tan. (b-a), tan. a} \left(\frac{V}{V_1 + \frac{2v}{3}}\right)$$

The somewhat lengthy derivation of this formula has been omitted, since the reader will derive more benefit from the resultant working formula.

Enough information has been presented so far to enable the reader to make some preliminary calculations, and to prove to himself by varying any of the values mentioned, what effect this would have on the propeller.

The efficiency and performance of the propeller will be affected by its plan form and aspect ratio, as in the case of an airfoil; in our case, however, the aspect ratio is taken as the *ratio of the radius to the greatest width* of the propeller blade. Calling this value AR, the diameter of the propeller can then be calculated from the following formula for a two-bladed propeller

$$\text{B.H.P.} = \frac{1.73\ Ky}{10^9\ AR} D^4\ N^2\ V_1 \left(\frac{ND}{V_1}\right) 0.1$$

in which

V₁ = Velocity of plane in feet per second.

D = Diameter of propeller in feet.

N = Revolutions per second.

For a preliminary estimate a good value for AR is 5.5 to 5.8. A good average value of Ky is 0.25, which is the absolute lift coefficient of the airfoil section at ¾ radius.

For a four-bladed propeller the value 1.73 should be changed to 3.34, the rest of the formula remaining the same as for a two-bladed propeller.

It is advisable not to simplify the formula and to figure ND/V₁ separately and *without* reference to the slipstream, since this has already been allowed for in the factors 1.73 and 3.34 respectively.

The above formulae are those given by the Engineering Division of the Air Corps and will prove very serviceable.

An easier formula for provisionally approximating the diameter is

$$D = \sqrt[4]{\left(\frac{K^2}{RPM}\right)} \cdot \frac{B.H.P.}{V}$$

in which K is a constant, of a fair average value of 300, this making K² = 90,000.

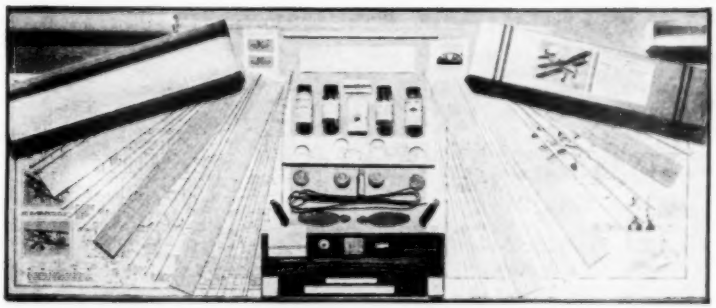
V, it should be noted, is here expressed in *miles per hour* and r.p.m. = revolutions per minute.

But in practice, the propeller must be adapted to the plane which it is to drive and minor corrections must be made for individual cases.

END

Yes Sir! C-D's Represent More For Your Money Than Any Other Kit, Regardless of Price . . . **Why, just look what you get in a**

3/4" C-D Great Lakes Sport Trainer



YES, it's just what you receive when you purchase a "Trainer" kit. Absolutely everything you need. The parts shown, too long a list to enumerate here, but as you can easily see, include all necessary tissue, wire, liquids, 2 instrument panels, rubber, propeller material, balsa strips and absolutely every part (nearly 200 pieces) printed out on the balsa wood; last, but most important, the authentic never-to-be-duplicated C-D "Trainer" drawing which makes it possible for you to build realistic C-D models. The picture at the left shows the standard model, but wheel and routed-out wheel shoe blocks are supplied for a speedster model, also described in the drawing. The model, colored cream and orange, has a span of 29", length 15⅛", and may be had by ordering Kit SF-1G, postfree..... **$2.65**

THE COMPLETED MODEL

All these 3/4" (SF) C-D Kits are Just as Complete as the One Above

SF-1G	G.L.S. Trainer	$2.65	14B	Fokker Tripe...	$2.50	25	Cur. A-8 Attack	$3.25	38	Buhl Bull-Pup...	$ .75
2D	T.A. Mys. Ship	2.95	15B	Fokker D-7....	2.95	26B	Heath Parasol..	.98	39	B. J. P-16.....	3.50
3B	deHavilland 4..	3.50	16B	Albatross D-5..	2.50	27	Doolittle's G. B.	2.50	40	Aeronca C-3.....	2.65
4	Curtiss JN4D..	3.25	17B	Bayle's G.-B...	1.95	28	Monocoupe.....	2.50	41	Vought Corsair...	3.75
5B	Laird Super S.	2.50	18B	Howard "Pete".	1.35	29	Boeing F4B-3..	2.85	42	Howard "Ike"....	.98
6	Polish Fighter.	2.95	19	Supermarine S.6B.....	2.50	30	Nieuport 28....	2.50	43	Douglas O-38....	3.75
7B	C. Helldiver...	3.50	20B	(Hawker) H. S. Fury	2.65	31	Hall Racer	2.75	44	Page's Racer....	2.65
8C	Boeing P12-E..	2.85	21B	Hawk	3.25	32	Boeing 95 Mail	2.50	45	Martin Bomber...	8.50
9	Sopwith SE-5..	1.25	22B	Curtiss F9C-2...	2.50	33B	Comper Swift....	1.25	46	Laird Solution...	2.50
10B	Sopwith Camel.	2.50	23	Boeing P-26....	2.50	34	Fokker D-8	2.50	47	Wedells, W.-Wms.	2.95
11B	A-W Quad....	2.50	24	Lockheed Vega..	3.25	35B	Boeing 247	8.50	48	Turners, W.-Wms.	2.95
12B	Nieuport Scout.	2.50				36	Lincoln Sport..	.98	49	Curtiss, F11C-2..	3.75
13B	Spad XIII.....	2.65				37	Waco C-3	3.25	50	C. Turkey Hawk..	3.75

C-D DWARFS--the SENSATION among low priced kits

D-42 How. Racer "Ike" 25c

D-19 Supermarine S.6B 65c

D-37 Waco C-3 75c

D-24 Lockheed Vega 85c

All authentic ½" scale. Other "Dwarfs" now ready are D-1G Great Lakes Sport Trainer 65c, D-8C Boeing P12-E 65c, D-20B Hawker Fury 45c, D-23 Boeing P-26 65c, D-26 Heath Parasol 35c, D-27 Doolittle's Gee-Bee 50c, D-29 Boeing F4B-3 65c, D-33 Comper Swift 30c, D-40 Aeronca 60c, D-41 Vought Corsair 85c, D-43 Douglas O-38 85c. Kits complete, except for liquids. If ordering by mail, add 10c per Kit for handling and packing charge. Don't delay building these. Buy several at once—the low price permits it. All 15 Kits, postfree, only $10.00.

BIG 1935 SALES AHEAD FOR C-D DEALERS: Send for discount sheet at once on these sensational sellers! 1935 is going to be a real year for dealers featuring C-D models, at prices to fit every pocketbook. Liberal discounts. Don't postpone your profits on the CLEVELAND line—write today.

2 FULL-SIZE MODEL PICTURES contained in newest C-D catalog. Also describes all C-D ¾" and ½" authentic scale models, and complete line of quality parts and supplies. Send 5c at once for your copy.

CLEVELAND MODEL & SUPPLY CO., INC.
1866PAB W. 57th St., Cleveland, Ohio, U.S.A.

The Trend of Lightplane Design

(Continued from page 98)

moment in terms of the absolute moment coefficient,

$$H = C_H c_e s_e q \quad \ldots\ldots (2)$$

Where:

c_e = Elevator chord (in.).
s_e = Elevator area (sq. ft.).
q = Dynamic pressure. (See equation 3.)
C_H = Hinge moment coefficient. (See equation 4.)

$$q = \frac{eV^2}{2} \quad \ldots\ldots (3)$$

Where:

e = Air density (slugs per cu. ft.).
V = Velocity (ft. per sec.).

$$C_H = C_1 a_s + C_2 B \quad \ldots\ldots (4)$$

Where:

$$C_1 = \frac{dC_H}{da_s} \text{ and } C_2 = \frac{dC_H}{dB},$$

or the slopes of the plots of C_H against d_s and B respectively. The angle of attack of the stabilizer (d_s) is expressed:

$$d_s = d_w + E + d_{t_o} \quad \ldots\ldots (5)$$

Where:

d_w = Angle of attack of the wing chord (deg.).
E = Angle of downwash (deg.).
d_{t_o} = Angle of stabilizer setting with respect to the wing chord (deg.).
B = Angle of attack of elevator relative to the stabilizer. (In equation 4.)

The angle of the stabilizer setting (d_{t_o}) can be found by solving the equation for the pitching moment of the airplane at cruising speed, since the stabilizer will be set to trim the plane at that speed, making the pitching moment and the hinge moment both equal to zero.

Writing the equation in the form of non-dimensional coefficients,

$$C_{M_A} = [C_{M_o} + C_L (a/c - .25) + C_C b/c] - [(S_t/S_w)(1/c)(dC_L/da)_t 7_t a_t] + [Th/cs_w q] \quad \ldots\ldots (6)$$

Where:

C_{M_o} = Wing moment about chord quarter point, from wind-tunnel curves.
C_L = Lift coefficient from curves.
a = Dist. from wing leading edge to center of gravity (in. + back.).
c = Mean wing chord (in.).
S_t = Total tail area (sq. ft.).
S_w = Total wing area (sq. ft.).
l = Dist. from c. g. to c. p. of tail (assumed at tail post., in.).
$(dC_L/da)_t$ = Slope of plot of tail lift coefficient against angle of attack.
a_t = Angle of attack of tail

$$= a_w - E + a_{t_o} + TB$$

$$= a_s + TB \quad \ldots\ldots (7)$$

All of the symbols in this expression but T are discussed above. T = (da_t/dB), or the slope of the plot of a_t against B.

7_t = Tail efficiency factor.
C_c = Wing chord force coefficient $= C_D \cos a_w - C_L \sin a_w$.
b = Dist. from wing chord to c. g. in inches (+ when c. g. is below chord).
S_s = Tail area in slip-stream (sq. ft.).
T = Propeller thrust (lbs.). = Total drag of airplane.
D = Propeller diameter (ft.).
h = Dist. from thrust line to c. g. in inches (+ when c. g. is below T.L.).

In equation 6 it is to be noted that the first bracket represents the pitching moment from the wing, the second that from the tail neglecting the effect of the slip-stream, the additional tail moment from the slip-stream, and the last the thrust moment.

Consequently, while the angle of attack of the tail (a_t) is expressed by equation 7 for both the second and third brackets, the value of the angle of downwash (E) must be modified for the slip-stream in the latter case.

For the case without the slip-stream, a very close approximation of the value of E can be obtained from the expression:

$$E = 26\, C_L/R \quad \ldots\ldots (8)$$

Where:

R = Wing aspect ratio.

The additional affect of the slip-stream can be accounted for by the expression:

$$E_t = 26\, C_L/R + a_w [(V_s - V)/V_s] [1 - (dE/da)]$$

Where:

V_s = Slip-stream velocity (ft. per sec.).
V = Velocity of plane (ft. per sec.).
dE/da = Slope of plot of E against a_w.

The value of the elevator angle (B) can be found from equation 4, since in the case now being considered $C_H = 0$. That leaves only T to be evaluated to have eliminated all of the unknowns from equation 7 but the one for which equation 6 is to be solved.

The value of (da_t/dB) or T depends on the shape of the tail surfaces, and on the ratio of mean elevator chord to the total mean chord of the tail surfaces. There is no way in which it can be computed, but its value must be taken from test data. Values of it for a given shape tail will be discussed later.

The tail efficiency factor depends on the shape and location of the tail, and usually lies between 0.65 and 0.80.

It must be noted that equation 6 involves both 1/c and a/c, or the tail length and the location of the center of gravity in terms of the chord. Since these are the two proportions of the airplane which are to be determined from a basis of the stick forces, it is obvious that the only possible procedure is to assume values for them, solve through for the stick forces, and if the force is not within the desired limits, to vary them slightly, and make another solution, until the desired result is obtained.

While this sounds like a long drawn out and tedious method, after having carried through the solution a few times, one learns just about what proportions will be required for any particular type of airplane.

Methods for determining the necessary amount of tail area, and any other factors in equation 6 which have not already been discussed, as well as the remainder of the solution for the stick forces after having found the value of a_s, along with a solution for the forces on the stick of the plane being designed herein will be considered in the following article of this series.

END

Back Numbers

We have a number of bound volumes of P.A. to sell at a reasonable price.

POPULAR AVIATION
608 S. Dearborn St. Chicago, Ill.

HELMET
AND GOGGLES
ONLY
$1
Here's the helmet you have always wanted. The P. A. helmet is worn by Aviators, Sportsmen, Autoists, Motorcyclists, and Motor boat operators. You can always use one and surely you don't want to pass up this chance of getting one for a dollar with a pair of aviator type goggles with leing'lass lenses thrown in free. Supply limited. Order now. Send a dollar to
P. A. PRODUCTS
Room 803 - 5 East 45th St.
New York City, N. Y.

The Aero-Sportswoman

(Continued from page 86)

The editor of this column is beginning to wonder what can be done to stabilize flying interests in the Middle West. In October we helped escort the flying Pattersons down to the Carolinas, in November our most air-minded friend, Theris McCarthy, left for New York, and now the Wakemans are leaving for California.

Anyway, we did enjoy the trip down through the Great Smokies, and now we are considering the possibility of going along to help Ruth fly the Fairchild out to the Coast. It should be good fun if we don't run into a Rocky Mountain blizzard enroute.

END

High-Lights

(Continued from page 83)

garding the decision of the National Labor Board or be subject to cancellation of their present airmail contract over the Amarillo-Brownsville, Texas, route.

Figures compiled by the various airlines indicate that the customary seasonal slump in traffic with the advent of cool weather is not evident this year and that comparison with figures for parallel periods of the previous years indicates a substantial increase in patronage . . . Prosperity is evidently just around the cloud.

OCEAN FLIGHTS: Igor I. Sikorsky declares that trans-Atlantic air service between the United States and England is an immediate reality, and that he believes that his next trip to London will be over the first air route connecting the two countries . . . Air France is constructing a huge flying boat capable of carrying eighty passengers on two decks which will be put into service across the southern Atlantic next June . . . Plans are being made by the Navy Department for a training flight by a squadron of large patrol planes from Hawaii to the Philippines.

HERE AND THERE: Contracts calling for the expenditure of $1,896,400 for 110 new attack planes have been awarded to the Northrop Corporation by the Army as part of the program to add at least 600 new planes to the air corps during the next three years . . . Air Commodore P. F. M. Fellowes, British flyer who last April succeeded in flying over the world's highest unscaled peak, Mt. Everest, was a recent Chicago visitor . . . Amelia Earhart is planning a Pacific flight . . . Campbell Black, co-winner with C. W. A. Scott of the England-to-Austria Air Derby, believes that two can fly as cheaply as one and so he and Miss Florence Desmond, the London actress, will be married in April.

Although Wiley Post failed to lower the altitude mark of the world, he established a new record when he went hunting and killed one buffalo and one elk with two shots . . . Kit Carson and Daniel Boone, American Airlines' pilots, fly daily between Chicago and New York, flying huge air transports which is quite a contrast to the covered wagon days of their famous pioneer namesakes . . . Pa Boone sent young Dan an ancient tome detailing the life of the original Daniel.

Nearly three million miles of air travel were represented when Pilots E. Hamilton Lee and Jack Knight got together . . . Lee is the senior airmail pilot of the world, having logged more flying hours than any other living pilot with Jack Knight a close second . . . Must congratulate them and also Mal Freeburg for their fine aviation broadcast . . . Did you know that Major Fiorello H. LaGuardia, mayor of New York and former war bird, is an accomplished trombone player and quite a linguist, speaking six languages?

Art Chester, speed ace, has completely recovered from injuries suffered in an AUTOMOBILE accident and is busy at Curtiss Airport . . . John Flannery, Municipal Airport, Chicago, rates a transport license at the age of 18, and is the youngest cub in Illinois . . . Art LaPointe and Judge Robert E. McMillan are still playing air golf.

Have you broken par yet, Judge? . . . Thanks for your letter . . . Would like to get in touch with Mike Caffarello who recently flew to Texas on a hunting trip and returned to Chicago with two bucks . . . What we want to know is if they were 60c bucks or the kind of bucks that Vice President Garner shoots when he goes hunting in his lone-star state.

Homer Cole, famed airline pilot, had wartime memories revived with the January cover of POPULAR AVIATION as Cole was chief test pilot for the Bristol Fighters . . . Cole is also the first man to ever receive a radio message from the ground to an airplane while in flight and during his long flying career has never worn a parachute.

PUBLIC SAFETY: According to J. B. Rathbun, POPULAR AVIATION intends to conduct a comprehensive and detailed study of airline crashes . . . A splendid program . . . Department of Commerce statistics show that for the past 5½ years an airline pilot has crashed to his death every 29 days and for the first six months of the current year a pilot has been killed every twenty days . . . Speed and fatigue are contributing causes.

One of the recommendations submitted by the pilots to the Air Commerce Bureau to be incorporated in the Bulletin 7-E was that air transports should not only receive the usual tests but should be operated over scheduled runs for at least 100 hours, 50 of which should be at night and WITHOUT passengers . . . The slogan of the airline pilots is SCHEDULE WITH SAFETY.

END

FOR MARCH

POPULAR AVIATION for March will be an outstanding issue. There will be articles of special importance to the lightplane fans and glider enthusiasts. New war stories—new types of planes—stories of aviation and the men who made aviation what it is.

Of special importance to our model builders and Photo Phans, will be a full page back cover drawing containing U. S. Navy squadron insignia in full color. This color plate is a fit companion for the insignia shown in this issue.

MAIL COUPON TODAY

POPULAR AVIATION
608 So. Dearborn St.
Chicago, Illinois

Gentlemen: Enclosed find $2.50. Please send me POPULAR AVIATION for one year.

Name.....

Address.....

City..... State.....

Selley When you need model parts, think of Selley—orders shipped within 24 hours.

ACCESSORIES

New Guns

With Ring MOUNT
1¼" long B 25e
1¾" long A 30c

SWIVEL TYPE GUNS C
2" Double Action 15e

PURSUIT TYPE GUNS D
¾" long.....5e
1" long.....5e
1½" long.....5e

TYPE F
1¾" long....10c

TYPE E
1¾" long....15e

DUMMY RATCHET GUN
⅞" long.....10c

Die Cast Bombs and TORPEDOES

13/16" 5e
1¼" 10c
3" Torpedo ...15e

DUMMY MOTORS
Something New
1" dia., 8 cyl. 30e
1½"dia., 9 cyl. 50e

Postage 3c Each

RUBBER TIRED WHEELS

Aluminum Disc Rubber Tired Tail Wheels
½" dia..... 5e ea.
⅝" dia..... 6c ea.
¾" dia..... 7c ea.
⅞" dia..... 8c ea.
1" dia..... 9c ea.
1¼" dia.....10c ea.
1¼" dia.....11c ea.

SEND 5c FOR CATALOG

Balloon Tire Alum. Disc
1½" dia.....25e pr.
1¾" dia.....26c pr.
2" dia.....30e pr.

Bal. Tired Cel. Disc Wheel
1½" dia.....30e pr.
1¾" dia.....33e pr.
2" dia.....35e pr.

Aluminum Disc Rubber Tired Air Wheels
1" dia.....18e pr.
1¼" dia.....20e pr.
1½" dia.....25e pr.

Treaded Rubber Aluminum Disc
1 3/16" dia...30e pr.
1½" dia.....40e pr.
2" dia.....50e pr.
3" dia.....60e pr.
5⅜" dia....$1.25 pr.
6½" dia....$2.00 pr.
7" dia....$2.50 pr.

Swivel Joint Fork and Axle
½ up to ⅝" wheel 10c
¾ up to ⅞" wheel 15c

Postage 3c Pair—on Rubber Tired Wheels, 4c Pair

PROPELLERS

Hawk Type 2-bladed	Hawk Type 3-bladed	Standard 2-bladed	Standard 3-bladed
3¼".....25c	4".....35e	1½".....10e	1½".....15e
4".....30e	4½".....45c	2½".....15e	2½".....20e
4½".....35e	5".....50e	3¼".....20e	4".....30e
5".....35e	5⅝".....60c	4".....25e	4½".....40e
5⅝".....40e	6¼".....70e	4½".....25e	5".....45e
6¼".....40e	7".....80e	5".....30e	6".....60e
7".....55e	8".....90e	5½".....35e	7".....70e
8".....65e	9"....$1.00	6".....40e	8".....80e
9".....75e	10"....1.10	6½".....45e	9".....90e
10".....85e	11"....1.25	6¾".....50e	10"....$1.00

Props can be had up to 24 in. dia. Postage 6c each.

Adjustable Pitch Aluminum Propeller

Suitable for Flying Models

2-bladed
8" dia. 35e
10" dia. 50e

3-bladed with Shaft
9" dia. $1.00
11" dia. 1.25

Special Shaft & Hangar
Threaded shaft with soldered arc flange....20e

Patented

Postage 3c each

PICTURES

ON BRISTOL BOARD 2¼" x 4¼" of AUTHENTIC AIRPLANES

24 ARMY.....25e Set
18 NAVY.....25e Set
16 WARTIME..25e Set
84 SQUADRON INSIGNIA.....25e

Postage 3c set

Spun Aluminum Cowls

Dia.	Drag Ring	Open Face	Closed Face
1"	15	15	15
1½"	18	18	18
2"	20	23	23
3"	28	28	28

Postage 6c

WORKING BRASS TURNED

Take-up	Toggled Long	Plain End
½"	⅝"...25e	...30e
⅝"	⅞"...30e	...35e
1"	1¼"...30e	...35e
1½"	1¾"...50e	...55e

Dummy Turnbuckles
¼" .....10e each
⅜" .....10e each
½" .....10e each

PEDESTAL BASE

Black lacquered base for your scale models from 10" to 24" wing span.....75e

Model Knife

Collapsible Blade
2" blade.....18e

Postage 3c Each

SHEAVES

Pulley Wheels or Sheaves made of brass, grooved to carry control wires, etc. 3/32" or ⅛"..3 for 10e 3/16" or 5/16" with bearing..4e ea., 4 for 15e

NUMBERS AND LETTERS BLACK GUMMED CUT-OUTS

Any letter or number in 4 sizes.
¼"—1e ea. | ½"—1½e ea. | 1"—1¾e ea. | 1¾"—2e ea.

IMPORTANT—Minimum order, 50c. Add postage on all items but if over 15c on less than $1.50 order add only 15c. Orders over $1.50 add 10%; west of Denver 15%.

SELLEY MFG. CO., INC. Dept. 402
1373 GATES AVENUE, BROOKLYN, N. Y.

Garros

(Continued from page 80)

1870 during the Franco-Prussian war, developed a new Nieuport. It was the first airplane to mount a Lewis machine gun, which incidentally was invented by Major Lewis of the U. S. Army in 1908. The gun was mounted on the top wing. It fired over the revolving propeller.

Garros took off in the new Nieuport. He little realized that he was to become the First Fighter of the French Air Service.

He met a lone German observation plane at 2,000 meters. The German observer-gunner trained his parabellum at the Nieuport; opened fire. He must have thought the Nieuport would be an easy victim. To the German airmen's amazement they felt the thump of bullets clipping through the fuselage fabric. Was this a French mystery ship? No Nieuport had ever been able to spray a Hun ship with lead before.

Garros sent long bursts at the Germans at long range. Three bursts of ten each before he realized his error. He heeled over and came up under the Boche two-seater. A long burst of ten. But the Boche pilot was zigzagging and banking skillfully. Garros got in a burst of four.

Still the enemy plane remained in the air. And the pan of the Lewis gun held only 47 rounds. Only three more rounds left! With grim determination Garros lunged at full speed at the German plane. He saw the German pilot glide into his ring sights. A last desperate chance with only three bullets.

The muzzle of the Lewis flickered red-orange flames and the Hun pilot slumped over in his cockpit. The plane nosed down in a tailspin. Crashed!

On his way back to the drome Garros was attacked by a German flight. His ammunition drum was empty. It was impossible to reload it up on the upper wing. If he stood up to put on a loaded pan the plane would go down out of control. Garros did the only thing he could do. He hi-tailed it back over the lines.

When he landed the adjutant greeted him thusly:

"Magnificent, Monsieur Lieutenant Garros. Confirmation of your first victory has just been received. You are France's first fighter. You are a real *pilot de chasse*."

"It was luck," said Garros quietly. "Next time it might be me who will go down. We pilots must have guns with more ammunition. I will figure it out."

Garros kept his promise. But he found the double sized Lewis pan with 97 rounds unsatisfactory. A *pilot de chasse* couldn't expect to do much fighting with less than a hundred rounds of ammunition. The gun must be placed where it could be easily reloaded in flight. The over-wing mounting was unsatisfactory. It and the gun created a parasitic drag resistance that reduced the speed of the Nieuport by at least seven miles an hour. This gave the German planes the advantage.

He decided there must be some way of mounting a machine gun close to the fuselage so its wind resistance would be reduced to a minimum. But the revolving propeller was in the way. Certainly some method could be evolved by which the stream of bullets pouring out of a machine gun muzzle at the rate of 400 rounds per minute could be made to miss a propeller turning at 1400 to 1800 revvs per minute.

Garros first tried mounting a machine gun alongside the fuselage. Here, he figured, it would offer little resistance. A comrade pilot had been carefully watching him. Deciding to steal

IMPERIAL LEADS IN QUALITY and VALUE

With every order of $1.00 or over postpaid

Free Offer

2-oz. Bottle Clear Cement and 50 1-16x1-16x18 Balsa Strips

18 IN. LENGTHS
1/16x1/16...80 for 5c | 1/8x1/4...10 for 5c
1/16x1/8.....35 for 5c | 1/4x1/4.... 5 for 5c
1/8x1/8.....30 for 5c | 1/2x1/2.... 2 for 5c

18 IN. SHEETS
1/32x1/16x2 .....8 for 10c
1/8x2 .....6 for 10c; 1/4x2 .....3 for 9c

18 IN. PLANKS
1x1 1 for ..... 4c | 2x2 1 for 18c
1x2 1 for .....10c | 2x3 1 for 23c

CLEAR DOPE, 1 oz. 5c; ½ pt. 30c

PROPELLER BLOCKS
1/8x3/4x6 .....6 for 5c
5/8x 1x7 .....3 for 5c
3/4x 1x8 .....3 for 5c
3/4x1 1/4x12 .....1 for 4c
1x1 1/2x12 .....1 for 7c

CLEAR CEMENT
1 oz. bot. 5c
2 oz. bot. ...10c
½ pt. bot. 35c

COLORED DOPE
1 oz. bot., all col. 5c

We pay postage on all orders for 75c or over. Under 75c add 10c. NO STAMPS. FREE LIST. Canada add 15%. West of Mississippi add 10c.

BAMBOO
1/16x1/16 ..36 for 5c
1/16x1/4x15 1c; doz. 10c

THRUST BEARINGS
1c each. 10c doz.

SANDPAPER, package ...5c

WIRE, 2 ft. ..1c; 25 ft. ..10c

INSIGNIA SHEETS
24 and strips 5c

BALSA OR BIRCH WHEELS
½"..pr. 2c | 1"..pr. 4c
¾"..pr. 3c | 1½"..pr. 5c
1¾" .....pr. 10c
3" in Balsa only .....pr. 17c

CELLULOID WHEELS
¾" .....pr. 5c | 1¾" .....pr. 10c
1" .....pr. 7c | 1¾" .....pr. 17c

MACHINE CUT PROPS
5" or 6".....5c; 7"..... 7c
8".....8c; 10".....10c; 12".....12c

SHEET ALUMINUM
.005 in. thick, sq. ft. .....15c; 6"x6"..... 5c
.010 in. thick, sq. ft. 20c

WOOD VENEER PAPER, 20x30, 1 for 10e

RUBBER, 1/16x1/16 .....18 ft. 5c

RUBBER, ⅛ flat .....15 ft. 5c

WASHERS, 1 doz. ⅛x¼..... 1e

BUSHINGS, 1 doz. 3e

REED, 2 ft. 1e

THINNER, 1 oz. 5e

SHEET CELLULOID
6x8....5c; 12½x16....20c

PROP. SHAFTS
1 doz. 5c

NOSE PLUGS
2 for 1e

JAP TISSUE
1 doz., all colors 10c

20 IN. FLYING PLANS 10c—3 for 25c
Texas Sky Chief, Sparrow Hawk, Gee Bee, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift L. W., Waco Cabin Bi-plane, S. E. 5, Douglas Dolphin.

Livewire dealers, clubs, schools: Write today for special proposition.

IMPERIAL MODEL AERO SUPPLY, 416 McDONALD AVE., BROOKLYN, N.Y.

Garros' idea and thereby win fame for the innovation of mounting a machine gun on an airplane, the pilot worked secretly in the hangar throughout one night making the installation on his ship. The next morning he zoomed up into the sky to give battle to the German pilots. At the first burst the propeller was literally cut off the ship and the pilot crashed to his death.

When the commanding officer learned the cause of the pilot's death he detailed Garros to special duty to develop his idea.

Garros designed and had made a set of steel planes shaped to protect the propeller blades in line with the gun muzzle. The theory was the bullets that didn't go through the space between the blades would strike the steel and not injure the propeller.

This method at first was a failure, ending in tragic results. The steel sleeves unbalanced the propeller and several crashes resulted. One French pilot was shot dead in his cockpit when a bullet ricochetted off a steel sleeve and killed him instantly. Another pilot was killed when the force of the bullets drumming on the steel cracked his prop and sent him down out of control.

It has been said nine French pilots gave their lives to the development of Garros' invention.

Shocked by the toll of death his unsuccessful device had caused in his escadrille, Garros vowed he would never permit anyone other than himself to test out his device in the air. He had discarded his side mounting idea and had mounted a gun in a fixed position on the top of the fuselage directly in front of the cockpit.

Then began a careful checking up of motor revolutions and the timing of the machine gun's firing. He stuck to his steel bands on the prop. He selected hardened steel, placed the sleeves mid-way along each blade. There the steel protected the wooden blades by deflecting the seven percent of bullets which struck the revolving blades. The other bullets sped through the space unobstructed.

The day Roland Garros made military aviation history was a raw biting cold February day in 1915. On that day, he climbed off the frozen tarmac to be the first pilot to shoot down a plane by firing a machine gun through revolving propeller blades. That day, although he little realized it, Roland Garros completely altered the conception of aerial fighting. His machine gun device gave birth to flight and squadron formations, to thrilling dogfights, to strafing of trenches and supply dumps. His idea changed air services into air forces. He made pilots and observers and their ships fighters in the world's greatest fight, instead of glorified onlookers.

Few planes were out that cold February morning. But Garros, after weeks of working to perfect his invention, was anxious to try out the mechanism. Well over the Huns' first line trenches, he spied a two-seat Fokker climbing up for a reconnaissance. The German plane approached Garros' Nieuport and seeing no machine gun mounted on the upper wing felt secure. Coming in close the German pilot turned to shout something to his observer-gunner—perhaps, what an easy victory it would be for the gunner at the parabellum gun.

At that moment Garros dressed his ship and pressed the machine gun trip. Rat-a-tat-tat. The German pilot never knew what killed him. A bullet from Garros' gun had drilled his head and made a flesh wound in the side of the observer. As the Fokker nosed over in a slow roll the Hun observer saw puffs of smoke belching from between Garros' propeller blade. He thought the smoke was from the French plane's motor. He was killed when the Fokker crashed and never knew he and his pilot comrade were the first victims of the controlled machine gun.

Garros never received credit for this first victory, but I have been told by reliable authority that the first two men to die at the point of Garros' machine gun were Under-Lieutenant Hugo Ackner and Flyer-Observer Fritz Dietrecks.

Neither the Allies nor the Germans had a great number of planes at their disposal during the early months of 1915. But by the time February was half over, Garros had shot down five

(Continued on page 129)

Approved! We have met the requirements of the Junior Birdmen Institute with our 24" Curtiss Robin and we have been awarded the seal of approval! This proof of quality plus our extreme low prices make G.H.Q. Kits the biggest model airplane values!

JUNIOR BIRDMEN OF AMERICA INSTITUTE

24" Flying Scale Models **25c** Plus 10c Postage

Each 24" G.H.Q. Kit is complete in every detail. A liberal quantity of everything. 18 models to select from at 25c each.

Puss Moth	Aeromarine	Nieuport
Polish Fighter	Army Hawk	Douglas Mailplane
Army Falcon	Monocoupe	Stinson "R"
Sopwith Camel	Fairchild "22"	Curtiss JN4
Fokker D-7	Aeronca	Bellanca
SE5	Fokker D-8	

24" CURTISS ROBIN 25c

36" FLYING SCALE MODELS **50c** Plus 20c Postage

36" DOUGLAS Y12 50c Complete

G.H.Q. KITS FLY BETTER, COST LESS, CONTAIN MORE — ALL HIGH QUALITY ACCURATE for EXPERTS EASY for BEGINNERS

These G.H.Q. Flying Scale Models are the best Kits your money can buy for appearance and flights. Buy one today and you'll buy a whole fleet of them. Get acquainted with G.H.Q. Kits and no others will do.

36" CURTISS A-8 ATTACK 50c COMPLETE

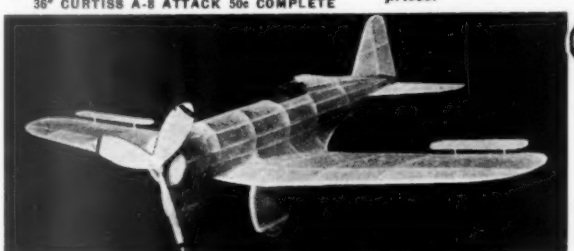
G.H.Q. Kits are contest winners, featuring design, detail, performance and low prices.

FLYING SCALE MODELS

5 ft. **1.00** EACH PLUS 35c FOR PACKING, POSTAGE AND INSURANCE

IF EXPRESS COLLECT SEND ONLY $1.00

5 FT. MONOCOUPE (Illustrated)
5 FT. STINSON RELIANT
5 FT. HEATH PARASOL



36" NORTHROP GAMMA "SKY CHIEF" 50c—COMPLETE IN EVERY DETAIL

Contains full-size plans, all parts printed on balsa, large bottles cement and dope, 50 ft. Jap tissue, rubber, ready-cut 3" wheels, wire, balsa strips, washers, movable controls, shockproof landing-gear, etc.

Send money order, check or cash. At your dealer or direct.

G.H.Q. MODEL AIRPLANE CO.
564P So. Boulevard, N. Y. C.

Do Not Fail to Include Postage — 1-Day Service

Aero-Books
POPULAR AVIATION
608 S. Dearborn St. Chicago, Ill.

Other men have read and profited by our free book "Patent Protection." Fully explains many interesting points to inventors and illustrates important mechanical principals. With book we also send free "Evidence of Invention" form. Prompt service, reasonable fees, deferred payments, thirty-five years' experience. Avoid risk of delay. Write immediately to: Victor J. Evans & Co., Registered Patent Attorneys, 527-D, Victor Building, Washington, D. C.

PATENT *YOUR IDEA*

JUST OFF THE PRESS!

OUR NEW 1935 CATALOG

A brand new 20-page catalog highly illustrated with 42 clear pictures. Gives you all the specifications, performance and data on three of the sweetest sport planes that ever took to the air.

WE NOW OFFER YOU THE—

CORBEN BABY-ACE JUNIOR-ACE SUPER-ACE

Here are three of America's foremost sport planes, all of proven design and performance. The Baby-Ace is a single-place, high-wing, open cockpit monoplane. The Junior-Ace is a two-place, side-by-side high-wing monoplane available in open or cabin models. This ship will out perform any plane of equal horsepower. An ideal ship for flying instruction. The Super-Ace is a single-place racy little job of high performance powered with our model A Ford conversion, making it the lowest priced sport plane on the market.

ASSEMBLE A CORBEN SPORT PLANE AT HOME

In addition to our flyaway ships we offer complete semi-factory built kits on all three ships for those who wish to assemble a Corben sport plane at home. Our new catalog gives you complete information, prices on flyaway ships, semi-factory built kits and blue prints.

SEND 10c FOR YOUR COPY TODAY

CORBEN

CORBEN SPORT PLANE CO.
DEPT. A
MADISON AIRPORT MADISON, WIS.

Pursuit Planes

(Continued from page 78)

The former, as a basic type with changes only in minor details and in greater horsepower, remained in the Air Corps until 1933. The designation PW-8 upon its modification was changed to PW-8A, further modification made it the PW-8B.

Upon the abandonment, in 1926, of the "pursuit-water-cooled" system of classification to "pursuit" regardless of cooling system, or type of pursuit work the model was to be employed in, the PW-8B became the P1-B. From then on successive improvements resulted in the ultimate P6-E, completed in 1931.

The PW-9, as a basic design, did not fare so well although the PW-9 was itself a more popular type than the unrefined PW-8. Beginning in 1927, it dropped gradually out of service over a period of two years. Other Boeing types, employing air-cooled motors, took its place in service.

The period of 1923-1927 brought out nothing that influenced or altered airplane design or air tactics. Suddenly in 1928 as if under a stimulus the Boeing and Curtiss Companies, exponents of conservative design, each brought forth a radical pursuit plane. Neither of these was successful as a type, but each undeniably affected the trend of design and construction.

The Boeing Company with the XP-9 began the vogue toward the monoplane form. This model, a semi-midwing, braced monoplane employing a 600 h.p. Curtiss Conqueror, made a startling contrast to the types then in service.

The effort of the Curtiss Company was the XP-10, a beautiful gull-winged creation. Another interesting feature was the reemployment of wing-surface radiators, a reversal of design to the PW-8. The same feature had been the greatest detriment to the complete success of the PW-8 and had been discarded in favor of the tunnel radiator.

During the 1928-1930 period, an imposing number of single-seaters were tested by the army. Among the better-known models tested were the Boeing XP-8, Curtiss XP-3, XP-11 and YP-20, and the Thomas-Morse XP-13A. The first-named is better known by its factory model number "66."

Arising triumphant from the competition, the Boeing XP-12 and Curtiss XP-6 types were awarded the major portion of the contracts. The Curtiss XP-6 was an outgrowth of the familiar P-1B, dimensions being almost identical with the earlier model and it excited but little interest.

The Boeing XP-12, on the other hand, received much deserved praise and in the newspapers and periodicals of the time it was variously touted as being the first plane equipped with a radial engine to be designed from the ground up with the motor feature in mind, that it was the fastest-climbing military plane in the world, and that in general, it was without a peer.

Until the year 1931 these two types with minor modifications held the majority of fighter contracts. During this time no serious challenger in single-seater form threatened the market of either.

The year 1931, the year that marked the induction of the high-speed bomber into the Air Corps, threw into the discard all single-seaters with speeds below 220 miles per hour. Deciding in favor of the monoplane as the most economical purchase of high performance, the Army broke a long precedent and adopted the Boeing XP-936 low-wing monoplane.

Three of this type had been completed in 1931, in great secrecy. It was in May, 1932, that the first pictures of this model appeared in print, these being newspaper pictures of the bootleg variety. Subsequently the designation resolved to P-26A and XP-29, as the later versions of this model are known. From its inception into the service until the end of the army fiscal year of 1933, 139 of this type had been contracted for, indicating how favorably this machine impressed the army.

SCIENTIFIC'S *DeLuxe* **25" HI-FLYERS**

New, bigger, more durable and better HI-FLYERS. Praised by noted builders from coast to coast. The choice of thousands of boys who want the best. Every kit complete—designed for perfect models.

$1 EACH POST-PAID

Guaranteed to Fly 600 Feet

25" STEARMAN, Model 81, $1 Postpaid

25" GREAT LAKES Sport Trainer, $1 Postpaid

25" VOUGHT Corsair, Model V80, $1 Postpaid

25" New MONOCOUPE, Model 145, $1 Postpaid

New 20-page, 1935 Catalog FREE: send 3c stamp for postage. DEALERS: write for discounts.

SCIENTIFIC MODEL AIRPLANE CO.
218-220 P2 Market St. Newark, New Jersey

Standard armament consists of one .30 calibre Browning machine gun on the left side (of cockpit) and one .50 calibre Browning machine gun on the right side. Principal dimensions are as follows: wing span, 27′ 11⅝″; chord, 6′; length overall, 23′ 7¼″; height, 7′ 10″. Originally equipped with a motor of 525 h.p. the models in production now are fitted with the 600 h.p. Pratt and Whitney Wasp.

The XP-29 is now undergoing tests. It represents one step further toward economic attainment of speed over the P-26A in the adoption of a retractable landing-gear.

Simultaneously, with the acceptance of the XP-936 in 1932, the Curtiss Company introduced the XP-934. A beautiful ship, the "Swift," as it was named, embodied the latest safety and comfort measures patented. Elevators and rudder were equipped with tabs for trimming the machine in flight. Automatic slots which could be locked in any position, and flaps on the trailing edge greatly reduced the landing speed.

This machine was the first pursuit plane in the United States to be equipped with flaps. Ordinarily, the short wing span of a pursuit model renders such equipment of little value, but owing to the policy under which this machine was constructed, i.e., utmost in performance at 20,000 feet, the span was comparatively long: thirty-six feet.

Intended primarily for high-altitude use the model offered for testing was, strangely, not equipped with a supercharger. The model number was altered to XP-31. Under this latter designation it was found to be lacking and rejected by the Air Corps.

With the last two years, the army has tested but one basically new single-seated combat plane other than the two mentioned. Beyond the fact that it is a Prestone-cooled Boeing, however, little is known.

In the navy, the trend of design in fighting aircraft has been slightly different than in the army. Until six years after the war it was the general concensus of opinion that only large flying boats were required for use with the nautical forces.

Upon the realization of the necessity of a more diversified service the Naval Aircraft Factory produced the TS-1 fighter. The TS-1 was a hybrid product that seemingly followed neither trend nor precedent, beyond that found in the bridge-builder's manual. The top wing was placed in a normal above-the-fuselage position, the lower wing was slung underneath. The predominant characteristic was the Warren truss system employed, further enhanced by an "N" bay strutting. The reason for the eccentricity of this design is that the primary feature was to be assembling ease, and no bracing wires were used. No naval fighter now in service bears any characteristics of this design.

In 1926, the first statement of the particular characteristics necessary to carrier service was issued. The qualities stressed were lateral stability, low landing speed, good vision downward, and ease of maneuver.

Among the types brought forth, the Boeing types FB-1 and F2B-1 and the Curtiss F6C-4 and F7C-1 were predominant. All were orthodox biplanes fitted with air-cooled motors. This latter fact was due to the reason that the navy had explicitly made known its preference for air-cooled types.

(See next page)

WORLD WAR RELICS

FOR CLUB HOUSE OR DEN

Vickers Aircraft Machine Guns—cost the Govt. about $700 each—rendered unserviceable without marring; just released by War Dept. Weigh about 33 lbs. Send M. O., Check or Draft for $7.75; or on receipt of $1.00 will ship C.O.D. by express.

FIALA OUTFITS, Inc., 47 Warren St., New York

BIG MONEY Assembling **NEW MEAD KI-YAK** at Home!

MEAD GLIDERS
12 S. Market
Dept. E2
CHICAGO

MEAD'S complete cut-to-fit KI-YAK Kit easily assembled for pleasure or profit! Can't sink. Portable. Serworthy . . . Light . . . Fast. Highest quality. Low cost. Opens a new world of sport for you both in sailing, paddling. Send 10c for illustrated folder. $6 Paddle now given with Ki-Yak—hurry!

"MISS LOS ANGELES"

Build this super detail, true scale model of the world famous speed queen of the 1934 National Air Races, flown by Roy Minor in the Thompson Trophy Race. Scale 1"—1 ft.
Most perfect and complete kit ever offered at any price. Note startling new features listed in next column. Real engineering!
Kit includes de luxe plans with numerous progress photos and views of finished model plus extra detailed instructions; generous supply of dope, banana oil, lacquer, cement, paint, etc.; very complete clear printed balsa, finished celluloid propeller spinner and finished engine nose cowl, turned wheels, bent wire parts, complete finished free wheeling propeller, supply of rubber lube, silver powder for details, all controls adjustable; complete model kit and all features listed in adjoining column. **Kit complete.....$2.50 prepaid**
Plans and instructions.....50c

NOW READY AFTER MONTHS OF MODEL ENGINEERING

Ralph Bushey's Shell Sweepstakes Winner—the Menasco powered Brown Special—all above features except wing flaps, optional 25c extra.
Kit complete.....$2.50 prepaid
Plans and instructions.....50c

LEE MILES' WORLD RECORD HOLDER

The Miles & Atwood Special—a sensational and beautiful model; same scale and features as above.
Kit complete.....$2.50 prepaid
Plans and instructions.....50c

REAL MODEL ENGINEERING BY THE WORLD'S LEADING MANUFACTURER OF RACING AIRPLANES BRINGS THESE NEW FEATURES TO THE MODEL BUILDER.

Never before available at any price!

Automatic Fuselage Jig
The back-bone of the model. Simplifies and speeds construction. Guarantees correct alignment.

Automatic Assembly Method
New, rapid, positive, accurate. Unites the entire model into one sturdy unit. No measuring, no guesswork. Simply assemble to plainly marked lines.

Tube Type Motor Guard
Protects fuselage from rubber failure and spattering of rubber lube.

Flaps That Work in Flight
Foolproof, positive, automatic.

Automatic Rudder
Compensates propeller torque, simple and sure in action.

FREE WHEELING PROPELLER WITH MECHANISM ENCLOSED IN BULLET NOSE.

ALL EXPERIENCED MODEL BUILDERS WILL RECOGNIZE THE SENSATIONAL VALUE OFFERED IN THESE FEATURES.

Model Builders' Work Kits with every Model Kit. Contains balsa knife, paint brush, glue stick, sandpaper, pins, thumb tacks, waxed paper, etc.

DEALERS—JOBBERS—CLUBS—Deal direct with an established aircraft factory. Write us.

Model Builders!

I want to hear from you. Please write me about your problems and activities. I am now contributing all of my twenty years' experience flying, fighting, and building world famous airplanes to the advancement of model building. Give 'er the gun—haul back on the stick—let's keep America First in the Air. Yours for American Aviation.
LAWRENCE W. BROWN

WARNING

The Lawrence W. Brown Aircraft Company is bringing many new features to model building to help advance aviation. No one else is authorized to produce models of Brown planes. This is done to protect model builders and assure them quality. All model features are protected by copyright and patent laws.

ORDER by Money Order only—or Cash at your risk. Send 10c for complete catalog and history of Brown racing planes.

LAWRENCE W. BROWN AIRCRAFT CO.
MODEL DIVISION
BOX 5 WILLOWBROOK
Dept. B CALIFORNIA

Lawrence W. Brown, President
F. R. McReynolds, Director of Model Division
Daniel E. Holloway, Model Engineer

ULTRA-MODERN

THE STRATOSPHERE

You don't know model airplane performance until you've seen the powerful, streamline Stratosphere in action. Calm air take-off run twelve inches, an amazing climb and the flatest glide you've ever seen.

Span 36" Length 28" Weight 1½ oz.

COMPLETE KIT Postpaid.....$2.25

BUNCH MODEL AIRPLANE CO.

"Models that really fly"

2303 S. Hoover St. Los Angeles, Calif.

A company owned and operated by Licensed Transport Pilots and Aeronautical Engineers.

COLUMBIA "TECH"

Now Offers Its FAMOUS RESIDENT COURSES For Home-Study Instruction

Recognized for 25 Years No Educational Requirements to Enroll.

Equipment and Texts Furnished without Charge. Courses Completed in One Year or Less. (Certificates issued upon graduation.)

Free Employment Service—Also Local Classes.

COLUMBIA "TECH" INSTITUTE

Box PA2-35 1319 F St. Washington, D. C.

Without cost or obligation please send me information on course checked below:

ENGINEERING COURSES

( ) AIRPLANE DESIGN
( ) Aerodynamics
( ) Stress Analysis
( ) Electrical Eng.
( ) Machine Design
( ) Mechanical Eng.
( ) Surveying and Mapping
( ) Steam and Gas Power Eng.
( ) Refrigeration Eng.
( ) Bldg. Construction Eng.
( ) Htg. and Ventilating Eng.
( ) Radio Eng.
( ) Architecture
( ) Highway and Bridge Eng.
( ) Air Conditioning
( ) Landscape Eng.
( ) Civil Engineering
( ) Mathematics

DRAFTING COURSES

( ) Mechanical Drafting
( ) Electrical Drafting
( ) Structural Steel Draft.
( ) Architectural Draft.
( ) AIRCRAFT DRAFTING
( ) Topographic (Maps)
( ) Patent Office Drafting
( ) Landscape Drafting

GENERAL COURSES

( ) Aircraft Blueprint Reading
( ) Mechanical Blueprint Reading
( ) Building Const. Blueprint Reading
( ) Building Construction Estimating

Name.....Age.....

Address.....

This School Does NOT Employ Salesmen or Field Representatives!

The following year, 1927, brought forth the F3B-1, a comparatively slow machine, but embodying a marvelous ease of maneuver. Beyond this plane and the advent of the two-seater as described earlier, no developments of great consequence appeared.

The year 1928 brought out the initial F4B Boeing fighter. This model corresponded to the P-12 of the army, and as previously stated, it was the first fighter built so as to embody all the benefits inherently possible to an air-cooled design. Today, the F4B with various refinements and serving under the designations F4B-3 and F4B-4 forms the backbone of the navy fighter squadrons. These are correspondingly the P-12E and P-12F on the army roster.

The years 1930-1931 gave birth to a few innovations in fighter design that persist today in late fighter models. The Hall XFH-1, interesting only because of its oddity, and the Berliner-Joyce XFJ-1 and Curtiss XF9C-1. The first-named was a biplane with the top wing swept back and lower wing swept forward, the whole presenting the appearance of a flying "X" when viewed from below and to the rear. During preliminary tests the wings pulled off in a dive, marking the end of the design in navy annals.

The second-named is a biplane of which the top wing was mounted in gull fashion to the fuselage with the lower wing slung beneath the fuselage. Subsequently, the same machine (only one had been submitted) was improved upon by employing a straight upper wing in place of the dihedral style of the former, but retaining the gull, and the mounting of an anti-drag wing. The improved model was known as the XFJ-2.

The third of these is the model built for service aboard the dirigible *Akron*. Compactness was considered a prime requisite and the dimensions bear out how well this feature was borne in mind. The model has a wing span of 25′ 6″, and an overall length of 20′ 1½″. The gull wing is another notable feature of this model. The present service model of this type, the "Sparrowhawk," is designated the F9C-2, and the major improvement over the original plane is in the installation of a cantilever landing-gear.

The year 1932 marked the entrance of the successful twin or double-row radial engine into the market, and an attendant flood of fighter designs.

The Curtiss XF11C-1 "Goshawk" was probably the first machine so fitted. Beautifully clean of line, and employing a single-strut landing-gear, this model mysteriously disappeared from the public view after some preliminary ballyhoo. The now designated F11C-2, also produced in 1932, seemingly found greater favor with the navy officials, for 27 additional planes were contracted for. This model mounts the 700 h.p. single-row Wright "Cyclone," but in other respects it differs little from the XF11C-1. The last of this series is now undergoing tests, designated the F11C-3, having been completed in 1933.

In all details except one this model is like its predecessor. The difference being in the use of a retractable landing-gear cowled into a hull-like addition to the bottom of the fuselage. This feature is not unlike that used on the Grumman FF-1 of one year earlier.

Two other single-seaters mounting twin-row radial engines were completed in 1932 and delivered in 1933. These were the Berliner-Joyce XF3J-1 and Boeing XF6B-1. Both at present are pending tests. It is definitely acknowledged that the latter has been accepted as service equipment. The Berliner-Joyce is a gull-winged product following this company's general practice of construction.

ALL PEERLESS

CURTISS NAVY HAWK

Pursuit and Dive Bomber. ¾" scale. Span, 23½". Length, 16¾". Painted in five colors. Postpaid only.....$2.75

GEE BEE SUPERSPORTSTER

Doolittle's speed sensation. ½" scale. Span, 12½". Length, 9 3/16". Colored red and white. Postpaid.....85¢

Flying Models

CATALOG

Shows all Peerless Supplies and Kits. Fully illustrated. Send 3c stamp for your copy.

All PEERLESS Kits have Printed Wood and Colored Dopes.

DEALERS

WE HAVE ALWAYS HAD A CONSISTENT POLICY OF CONGENIAL COOPERATION. It means additional profits to you.

15% additional west of Denver.

SOPWITH CAMEL

Well-known war plane. ¾" scale. Span, 20". Length, 14⅜". Colored yellow and red. Postpaid only.....$1.50

WACO CABIN BIPLANE

A well-detailed beauty. ¾" scale. Span, 24⅞". Length, 18⅜". Colored cream and green. Postpaid only.....$3.00

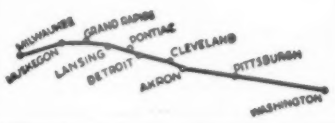
PEERLESS MODEL AIRPLANE CO.

15535A Madison Ave. Lakewood, Ohio, U. S. A.

FLY PENNSYLVANIA AIRLINES

AND TRANSPORT COMPANY

NOW 3-MILE-A-MINUTE BOEINGS



FREQUENT DAILY SCHEDULES

The Boeing XF6B-1 is a biplane embodying the principles that made successful the F4B type, and marks the reversal back to the biplane design; this upon the failure of the XF5B-1 monoplane to establish itself favorably as a service type. A longer, thinner fuselage, a simplified strutting system, and a vastly cleaner landing-gear mark the transition of the earlier type into the later. The Berliner-Joyce and Boeing are both equipped with the Pratt and Whitney Twin Wasp of about 700 h.p.

Other single-row radial-engined types introduced in 1933 were the General Aviation XFA-1 and Boeing XF7B-1. The General Aviation (nee Fokker) product is a gull-winged biplane following the lines of the Curtiss "Sparrowhawk." A deeply-sleeved landing-gear is its most distinguished feature. It was rejected as a service type.

Information concerning the Boeing XF7B-1 is nebulous, but it is definitely established that it is powered by a Pratt and Whitney motor of 700 h.p.

The Northrup XFT-1, built by the Northrup Aviation Corporation of Ingleside, California, is the most interesting of the newer fighters. Delivered to the navy in 1934, it seems predestined to disrupt the ancient policy of the navy to frown upon any aircraft of monoplane form, especially of the low-wing type.

This model, a remarkably compact edition of the "Delta" commercial model made by the same firm, is powered by a twin-row Wright of 700 h.p. The wing is of cantilever construction, and the design is unique in the employment of a full-skirted fairing of uniform thickness running from wing to wheel, covering the latter. The cockpit is completely enclosed by a sliding glass cover. This model, at the time of writing, is undergoing carrier tests at Hampton Roads, Virginia. The estimated speed is 300 miles per hour in level flight, with a terminal diving velocity approaching 500 miles per hour. The appearance of the plane bears out these imposing figures.

It is difficult, however, to ascertain correctly the speed of a new military airplane. The process, in part, involves striking a happy medium between the obviously underestimated performance figures issued by our services, and the ecstatic guesses of feverishly patriotic aircraft enthusiasts who claim knowledge from direct sources.

There are a few additional naval fighters delivered in 1934 of which little information is available. These are the Bellanca single-seater, Grumman XF2F-1 single-seater, and Douglas two-seater. Of the two former models the production of a single-seater fighter marks an initial attempt of these companies into this field. Of the Douglas the construction of a two-seater fighter for carrier work is also an initial procedure.

To summarize the foregoing:

The army now seems fully aware of the potentiality of the two-seater fighter, with a seeming preference for this type fitted for high-altitude tactical use. The single-seater, however, predominates in numbers. There is also evident an almost universal purchase of monoplanes.

The navy, as the original foster of the two-seater fighter, regards this type with the same favor as does the army, but in accordance with its traditions, the navy chooses the biplane as most fitting for carrier work. In this service, too, does the single-seater continue to predominate in numerical strength. Of the single-seaters, the biplane rules, with the monoplane threatening to blast the prejudice against itself as a carrier fighter.

END

Check-Ups

(Continued from page 89)

cause they haven't been properly safetied so it would be advisable to carry a spool of safety wire in your tool kit at all times.

The above discussion has necessarily been limited to those parts of the airplane which are directly or indirectly responsible for the majority of accidents due to carelessness. However, there are scores of other parts that need careful maintenance and, in the words of the Air Commerce Bureau report, ". . . and we earnestly recommend that the safety of your airplane be entrusted only to qualified personnel who are adequately equipped to perform a thorough job."

As a bit of closing advice, it is very good practice to pay strict attention to the recommendations which both aircraft and engine manufacturers issue from time to time as they are usually alert to guard the integrity of their name and reputation. Occasionally, they even forward owners of equipment of their manufacture replacement parts or instructions which they have tested and found to be an improvement to their product.

END

Popular Aviation
Five Months for $1.00
POPULAR AVIATION
608 S. Dearborn St. Chicago, Ill.

WORLD WIDE ALL WAVE RADIO

Get stations all over the world with this POWERFUL radio receiver! All Wave—15 to 600 meters! Works on two inexpensive batteries. NOT a toy or attachment! *Results Guaranteed!* Ace kits include all parts mounted on attractive metal chassis and panel. Clear picture instructions. Wire it yourself! It's easy! *Send for free literature.*

$1.95

ONE TUBE KIT $1.95 • TWO TUBE $2.85
ALL ELECTRIC 105-125 volt AC-DC two tube house current set. No batteries needed! Complete Kit $3.65.
Kits wired 75c extra. Tubes 85c each. Double phones $1.25.
ORDER NOW! Send $1, balance COD, or postpaid if full remittance.
LOOK!! Large three color Map of the WORLD, U. S., valuable Short Wave data, etc !! Send 10c for mailing, NOW!
Ace Radio Laboratories 1619 Broadway Dept. PA2 New York City.

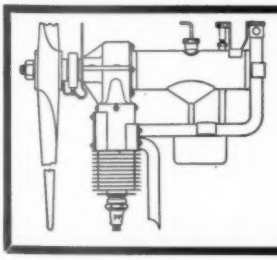
Fly In Comfort

WILEY POST did. So have many other famous conquerors of the Air. Rapid variations in altitude and sudden, swift motion place an unusual strain upon the system. Even the strongest constitution and most experienced flyer may feel discomfort at times. Take—

Mothersill's
AIRSICK
Remedy

—and prepare the system for these sudden changes and an enjoyable trip is assured. The cost is small, only 50¢ per box at Druggists, Air Ports, general stores or direct on receipt of price.

The Mothersill Remedy Co., Ltd., N. Y.



LATEST INVERTED *DESIGN*

Build the "Mighty Atom" series III model airplane gasoline engine. Made of finest aluminum and steel. View at left is ¼ full size.

Complete set scale dwgs. $1.00 Or detailed literature 25c

Bore.....1½ Wtg.....12 oz. R.P.M.....3,000
Stroke.....1½ Prop....18" dia. H.P.....½-¾

NEW IDEA MFG. CO. Dept. P-2 WHITEWATER, WIS.

Silk-Worms

(Continued from page 82)

cations was promoted by the business men of a newly-built town in Wyoming. A local Guard Observation Unit was invited to compete in an air race—and because of the knowledge that a relative of one of the flyers was backing the celebration, little doubt was held as to the outcome.

Seven or eight planes were available and that meant fourteen or sixteen men out of twenty pilots could go to the race. Naturally, the ranking officers would go. Of the juniors only a few could be included. Since the promoters always saw that the flyers were royally entertained, there was much interest and speculation as to which of the juniors would be included.

One of these younger men who had not expected to be chosen, was informed at the last minute that he had drawn the lucky number and found he could not get his best whip-cord uniform home from the cleaners in time to wear it. His only alternative was a pair which had been patched in the seat. Wifely admonitions warned him to be as inconspicuous as possible—and he departed.

On the way to the celebration one or two of the planes made forced landings and damaged their wing tips, which disqualified them. Our hero pushed along, doing his best, but with no hope of winning. He circled carefully to pick his landing—and settled down. Gay plans were fulfilled and the squadron met at the big new hotel after some liberal and very moist entertainment, for dinner.

During the gaiety, the Major came quietly to where our hero sat wondering who had won the race—and said softly—"You'd better make that drink your last one. You might have to make a speech a little later." Judged on efficiency and skill—our hero with the patched whip-cords had won the race. He missed the dance in his honor and he had to make his speech from a corner—but the squadron celebrated.

Trophy and money prizes were the awards at these races and the squadron party fund grew apace. With the coming of leaner times, the parties were curtailed by Administration rulings against any activities which might smack of display and came also a more economical dedication ceremony. So this phase also passed.

Out of these dedications, however, grew the National Air Races and National Aeronautical Association, another development. Three of these first races were held in Cleveland and in time this movement will assume large national proportions. Members of the N.A.A. are officiating judges at all air-meets.

The cowboy tells a story about a tenderfoot who sat perched timidly upon a horse after being mounted with some difficulty. The inexperienced one held the reins tightly in one hand and the pommel of his saddle with the other and inquired, carefully—"What shall I do if he bucks?" The barnstormer has a parallel story to tell.

The air was light and mushy—"screwy" it is sometimes called. Atmospheric storms all around the city had caused a sort of pocket in which it was extremely difficult to fly. By working hard, the pilot could just about keep the nose of his plane in the air. The tail kept drooping like the ears of a bucking bronco. Barely pushing the air, the pilot circled over the city slowly with his "rubes."

Suddenly, the passenger in back with his girl friend leaned forward and tapped the pilot's shoulder urgently. "Hey!" he called above the roar of the motor. "Hey! What would you do now, if the engine'd buck?" Half mad with his own responsibility and the effort he was making to keep his plane in the air at all, the pilot made historic answer. "What could I do? Let her buck!"

Most ironic of contrasts, those cowboys who come to the fair—daring riders all, love this new steed. Here at the last stand of the old frontier, where the air circus makes its appearance in mildest form, the cowboys gather 'round. To them steer-roping and bronco-fanning are inane.

Time after time the same lithe riders snap safety belts across their lean middles and sail into the blue vault of Heaven on the modern spirit of adventure. Times without number, they urge the pilot in his "saddle"—"Five dollars for one little buck, cowboy. Give her the spurs, feller—she ain't done nothin'!" Then down again to earth.

And then—some of them bucked and stayed permanently in the old corral. Just another lean, hard, adventurous boy went west because he took one too many chances at pleasing his passengers. This job was not all beer and skittles, it was good, tough work with almost unsurmountable hazards thrown in for good measure, but even then the love of the game kept leading them on and on.

It is hard to believe that this barnstorming plane is the same winged enticement as the steed which so thrilled our hearts by its airy prancings a few short years ago. As the pilot settles his plane gently down again, his passengers alight and wander soberly away. Most of them wear the baffled expressions of those who had hoped to be thrilled—and were not. The thrill, with the air circus, is dead. Pegasus is tamed.

END

Let Me Tell You

About your business, travel, changes, matrimony, love affairs, friends, enemies, lucky days and many other interesting and important affairs of your life as indicated by astrology. Send for your special Astral Reading. All work strictly scientific, individual and guaranteed satisfactory. FOR MANY YEARS PRIVATE ASTROLOGICAL ADVISER TO ROYALTY and the ELITE. Write name, address and date of birth plainly. No money required, but if you like send 15c (stamps) to help defray costs. Address: PUNDIT TABORE, (Dept. 518), Upper Forjett Street, BOMBAY VII, BRITISH INDIA. Postage to India is 5c.

FREE! with EVERY order

Actual photo 12 in. flying Vought Corsair

A COMPLETE KIT FOR THE ABOVE PLANE

A real Christmas gift for you. This kit contains EVERYTHING necessary to build the plane pictured above. Make up your order from low list below, add 5c for postage on kit, and prepare for a thrill when you see our superior supplies and free kit.

All Materials Guaranteed

BALSA WOOD 18" STRIPS

1/16 sq. .....35 for .05
1/16x1/8 .....20 for .05
3/32x3/32 .....18 for .05
1/8 sq. .....16 for .05
1/4x1/8 .....10 for .05
1/4 sq. ..... 5 for .05
1/2 sq..... 2 for .05
1 sq. ..... 1 for .05

18" SHEETS

1/32x2 .....6 for .10
1/16x2 .....6 for .10
3/32x2 .....5 for .10
1/8x2 .....4 for .10
1/4x2 .....3 for .12

18" PLANK BALSA

1x3 .....1 for .15
1x6 .....1 for .25
2x3 .....1 for .25
2x6 .....1 for .45

All above sizes available on 36" lengths. Double cost of 18". Add 10c postage extra.

BALSA PROPELLER BLOCKS

1/2x3/8x5 .....9 for .05
1/2x3/4x5 .....7 for .05
1/2x3/4x6 .....7 for .05
5/8x1x7 .....3 for .05
3/4x1x8 .....2 for .05
3/4x1-1/8x10 ...2 for .07
3/4x1-1/4x12 ...1 for .04
1x1-1/2x12 .....1 for .06
1x1-1/2x15 .....1 for .07

CLEAR DOPE OR THINNER

1/2 oz. ..... .04
1 oz. bottle ..... .05
3 oz. can ..... .11

24-Hour Service

MODEL DOPE BRUSHES

Per doz. ..... .10

COLORLESS CEMENT

1/2 oz. tube ..... .04
1 oz. bottle ..... .05
3 oz. can ..... .14

COLORED DOPE (ALL COLORS)

1/2 oz. bottle ..... .05
1 oz. bottle ..... .07
3 oz. can ..... .15

WASHERS

1/8" O.D. or 1/4" O.D. per doz. .02

JAPANESE TISSUE (20"x24")

White .....per doz. .20
Colored, all col., ½ doz. .11

RUBBER

.045 sq. .....20 ft. .05
1/16 sq. .....20 ft. .06
1/8 flat .....17 ft. .05
3/16 flat .....12 ft. .05

THRUST BEARINGS

Small or large..2 for .03

HARDWOOD OR BALSA WHEELS

1/2" .....per pr. .03
3/4" .....per pr. .04
1" .....per pr. .05
1-3/8" .....per pr. .07
1-3/4" .....per pr. .11
2" .....per pr. .13

BAMBOO

1/16 sq. .....doz. .03
1/16x1/4 .....doz. .07
Sheet Celluloid, 2"x8" .02
Model Pins, lge. pkg. .05
Sandpaper, large pkg. .05

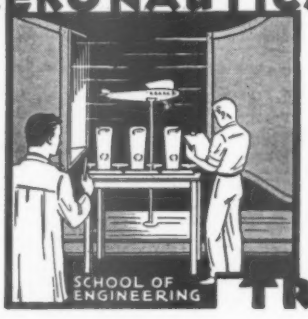
Ordering Instructions: 1. No orders under 50c. 2. Add 15c postage plus 5c postage for free kit.

Dealers, Clubs: write for lowest wholesale list out.

MODEL AIRPLANE UTILITY CO.
5307 New Utrecht Ave., Dept. PB, Brooklyn, N. Y.

AERONAUTICAL ENGINEERING

DEGREE IN 2 YEARS



Become an Aeronautical Engineer. Tri-State College course given in 108 weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Equipped with wind-tunnel (see illustration). Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Properly trained engineers in design, research, manufacture and sales work are in demand. Enter March, June, September, January. Courses are offered also in Civil, Electrical, Mechanical, Chemical, Radio and Architectural Engineering; Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. World famous for technical 2-year courses. Graduates successful. Write for catalog.

725 COLLEGE AVE. ANGOLA, IND.

TRI-STATE COLLEGE

Garros

(Continued from page 123)

enemy planes. When asked where he had shot them down so that they could be confirmed, Garros shrugged his shoulders indifferently.

"To me the number I shoot down is nothing," Garros said. "It is *how* my invention functions. Always I am studying it and how it works my gun. I have no time to draw a picture of where my brave adversaries fall."

To Garros the perfection of his mechanism would be a greater achievement than killing more enemy pilots than any other Allied pilot.

Garros' first victory with his gun was over a Fokker. It was a strange twist of ironical fate that forced him to deliver his secret into the hands of the enemy and a Fokker plane was the first ship of the war to mount a synchronized machine gun. The synchronizing was a perfection of Garros' idea.

On April 19th, Garros rode the clear Spring sky in search of a sixth victim. But German planes that drew near immediately veered off when they saw the strange mystery Nieuport that in some unfathomable manner spat death from its nose. Unable to get within range of a Hun plane Garros swooped down on a train of supplies. Over the train he released the bombs from his ship. And as they were exploding he cut the throttle, went down closer in a steep silent dive to spray the soldiers swarming from the wreckage.

Garros became the first man of the war to ground strafe troops with a machine gun mounted behind the engine. The ground swung up at him. Garros switched on the ignition, sauced the motor. Instead of the snort of the motor taking the nursing there was only the mocking whistle of wind through wires and struts.

Bullets from the angry troops below were now ripping and tearing through the fabric of his fragile plane. Desperately Garros struggled to nurse his engine to respond. But that steep dive had sent oil into the engine and fouled the spark plugs.

Garros was doomed!

He made a dead stick landing on a narrow road. One wing was ripped off as the plane rolled into a telephone pole. Shaken and jarred Garros unfastened his safety belt, leaped out to set fire to his plane.

Soldiers, in mustard-green uniforms, with rifles and Lugers came on the double toward the French plane. Just as Garros was striking a match to fire his plane to prevent the secret of his invention from becoming known, a Mauser gun butt cracked down on his head.

He fell face forward. His body smothered out the burning match he had struck. Garros, unconscious, was taken to a hospital—a prisoner. His plane was sent to the rear for careful inspection by intelligence officers.

On July 1st, 1915, a Fokker plane, mounting a Spandaus machine gun on the fuselage before the pilot, and controlled by a synchronizing gear, appeared on the Front. Garros' idea had been perfected and was immediately used against French pilots in retaliation.

Recovering from his head injury, Garros was sent to a prison camp. Because Pinsard had managed to escape, Garros was kept under constant surveillance of especially alert guards. For two years he endured the privations of German prison camps. Most of the

(Concluded on page 132)

SHORT COURSE Teaches Fundamentals-Saving Time and Cost

Thousands of students, beginners and air-minded people everywhere have been waiting for just such instruction. Written by H. O. Claywell, licensed pilot (International). Amazingly simple, condensed; makes learning to fly seem easier than learning to drive a car; saves many precious hours of time and expensive instruction.

Only 55 Simple Rules and Movements to Learn

A school boy can memorize and drill himself in these essentials which are, in a practical sense, common to all aeroplanes. Aviation schools and private instructors approve and recommend this book as it helps them turn out able pilots in record time. Thousands become interested in flying when this book shows how easy, simple and safe it is.

Every Detail Is Clearly Illustrated—Over 60 Photos

In addition to simple, condensed text, the story is told in picture. Anybody can understand the principles and movements it teaches. When you learn all there is in this book, you can almost qualify as an advanced student.

Fully Endorsed by America's Million Dollar Flying School

Instructors to many of the Nation's Ace pilots. There is at least $50.00 worth of flying instruction in this book. You get it all for less than the cost of one hour's personal instruction.

SPARTAN SCHOOL
of Aeronautics; Dept. PA-1; Tulsa, Okla.

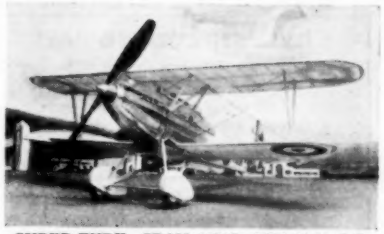
Gentlemen: Enclosed please find $1.75 for which send me postpaid your new improved short course in the fundamentals of flying.

NAME _____ CITY _____

STREET NO. _____ STATE _____

LINDBERG

AUTHENTIC ¾" FLYING SCALE MODELS
ALL PHOTOGRAPHS OF ACTUAL MODELS



SUPER-FURY—SPAN 19⅝"—KIT $1.50 P.P.

RYAN-ST—SPAN 18¾"—KIT $1.00 P.P.

FINISHED SPINNERS, SEMI-CUT PANTS, SHOCK ABSORBING LANDING-GEARS, MOVABLE CONTROLS FROM COCKPIT, PRINTED-OUT BALSA, COLORED DOPES, LACQUERS, ETC., OVER A HUNDRED PIECES IN EACH KIT. MODEL BUILDERS PRAISE LINDBERG KITS. "BUY THE BEST."

Dealers—Write for Particulars
LINDBERG MODEL & SUPPLY CO.
Dept. L, 5324-28 N. Kedzie Ave., Chicago, Ill.

"IN ENGLAND"
Northern Model Aircraft Co.
11 A High St., Manchester 4

Boys! Get this FREE OFFER

Simply send us your name and address and we will send you a full three-view PLAN of a "SWIFT" CURTISS PURSUIT, 20" wingspan.

Dealers—Clubs—Schools—Write for Special List

Balsa, 18 in. Lengths
1/16x1/16..15 for 1c; 1/16x⅛.....6 for 1c; ⅛x⅛.....8 for 1c; ⅛x¼.....2 for 1c; ¼x¼.....1 for 1c; ½x½.....1 for 3c;

Balsa Sheets, 18 in.
1/32x1/16x2.....10 for....10c; ⅛x2.....1 for 2c; ¼x2.....1 for 3c;

Balsa, 18 in. Planks
1x1..... 2 for.... 5c; 1x2..... 1 for.... 8c

Propeller Blocks
½x⅝x6.....1 for 1c; ⅝x1x7.....1 for 2c; ¾x1x8.....1 for 2c; ¾x1¼x12...1 for 3c; 1x1½x12....1 for 6c;

Wood Veneer Paper
20"x30", 1 for 9c; 2 for.....15c

AA Japanese Tissue
1 doz., all colors.....16c

Clear Dope
2 oz..... 8c; ½ pt.....25c

Insignias
24 for..... 5c

Rubber Motors
1/16 square, 20 ft. for..... 5c

Washers
¼x⅛, doz... 1c

Clear Cement
1 oz..... 5c; 2 oz..... 8c

Sheet Celluloid
6x8 4c; 12x16 18c

Reed
3 ft..... 1c

Wooden Wheels
½", pair..... 1c; ⅝", pair..... 2c; 1", pair..... 3c; 1⅜", pair..... 4c; 1¾", pair..... 8c

Nose Plugs
2 for..... 1c; 12 for..... 8c

Thrust Bearings
1c each; doz. 10c

Bushings
1 doz..... 2c

Bamboo
1/16x15, 20 for 3c; 40 for.... 5c; 1/16x¼x15, 2 for..... 1c

15" Wingspan, 6c each; 3 for 16c.

Celluloid Wheels
⅝", pair..... 5c; 1", pair..... 6c; 1⅜", pair..... 8c; 1⅞", pair....15c

20" Wingspan, 8c each; 3 for 20c. Waco Biplane, Texaco Sky Chief, Spad Chasseur, Swift Curtiss, Sparrow Hawk, Vought Corsair, Gee Bee, Ott Hydro Model.

Wire
2 ft. 1c; 26 ft. 10c

Colored Dope
1 oz. 5c; 2 oz. 8c. All colors.

Thinner, Best
1 oz..... 5c

Sandpaper
Package.....5c

9" Wingspan Plans, 5c each; 3 for.....12c

Aluminum Leaf
2 sheets for 1c

FREE WITH ORDERS OF $1.00 or more. COMPLETE KIT to build famous dirigible LOS ANGELES with mooring mast.

SKYWAY IS THE EASY WAY TO GET THE BEST FOR LESS.

GET OUR CATALOG FOR OTHER BARGAINS

ORDERS 50c or under 15c postage. Postage prepaid on orders over 50c. West of Mississippi add 10c extra. Canada add 10c extra. CASH OR MONEY ORDER—NO STAMPS.

SKYWAY MODEL AIRCRAFT SUPPLY COMPANY
NEW YORK 7 Fuller Avenue FLORIDA
FLORAL PARK, NEW YORK

Advertise in this Directory.

BUYER'S DIRECTORY

Rates: $5.00 per inch.

AIRPLANES FOR SALE

3 CYL. AIRCOOLED "40"

For all lightplanes. Priced within your reach. Either complete or assemble motor yourself from parts. Circular free. OX5 mono., excellent covering, $165; American Eagle, snappy OX5 motor, $250.

Corben Baby Ace Kit, factory-welded fuselage, finished ribs, 20x4 tires, $95.

ALLISON AIRPLANE CO. Lawrence, Kan.

Snow sled propellers	$ 5.00
0-18000 foot altimeters	2.00
0-20000 Zenith	4.00
Fur-lined winter flying suit	9.00
Robin fuselage for snow sled	30.00
Heath fuselage, wings, tail unit	30.00
Cirrus mark III motor	125.00
LeBlond 65	175.00
American Eagle OX5, repairable	125.00
Eaglerock, damaged	75.00
Kinner American Eagle, less motor	350.00

MARVIN A. NORTHROP AEROPLANE CO.
Minneapolis, Minnesota

New Aeroplanes, Less Motor, $98.00

Powered with Ford motor and flight tested, $148.00 each. New production, beautiful mid-wing design, complete with 7.00-4 air wheels. We expect to build several hundred. Send 25c for more information.

UNIVERSAL AIRCRAFT CO.
FT. WORTH, TEXAS

AIRPLANE ENGINES

WANTED!

LIGHTPLANE ENGINES
SALMSON A-D-9 PARTS

We buy, sell and trade engines up to 60 H.P. If you have a motor to sell or trade send us details. Send 3-cent stamp for price list.

CORBEN SPORT PLANE CO.
Madison Airport Madison, Wis.

AIRPLANE PARTS AND PLANS

BUILD THE **CORBEN SUPER ACE**

FORD POWERED ONE-PLACE SPORTPLANE
COMPLETE SET OF LARGE
DETAILED BLUE PRINTS
FORD CONVERSION SET $3.50—PLANE $5.00

CORBEN SPORT PLANE CO.
MADISON AIRPORT MADISON, WISCONSIN

? ARE YOU STUMPED ? ? WHAT DO YOU NEED ? ?

WRITE US FOR QUOTATIONS
AIRCRAFT WELDING—NEW AND USED PLANES
AIRCRAFT REPAIR—NEW AND USED MOTORS
MOTOR REPAIR—BLUE PRINTS
PROPELLERS—SUPPLIES
LICENSED A & E MECHANICS

RETZ AERO SHOP
FARMLAND MUNICIPAL AIRPORT
FARMLAND, IND.

Build your own Ice Boat, Lightplane or Midget Racing Car from Storms Simplified Plans. Small, powerful engines, chains, sprockets, wheels, tires, axles, efficient air propellers and hubs at rock-bottom prices. New circulars 10c.

STORMS AVIATION CO.
13 Southside Ave., Asheville, N.C.

AIRPLANE SUPPLIES

DON'T BUY ANYTHING UNTIL YOU GET ORT'S 1935 AVIATION MATERIAL CATALOGUE. PRICES ARE LOWER. SEND ONE THIN DIME TODAY.

KARL ORT, 653 W. POPLAR ST., YORK, PA.

THANK YOU!!

Many thanks to all who answered our first ad appearing in the December issue of POPULAR AVIATION. Many thanks also to those persons favoring us with their orders placed directly from the ad.

From now on, each and every month through the medium of this directory, we will bring you SPECIAL OFFERINGS. These will mean REAL BUYS and SUBSTANTIAL SAVINGS for you. HERE THEY ARE FOR THIS MONTH:

SPRUCE, 500 ft., ¼x¼, ¼x⅜	$3.75
HASKELITE, 1/16" birch plywood, new production, panel 24"x60"	1.75
AIRPLANE FINISHING LACQUER ENAMELS, all standard colors, per gallon	4.75
AIRPLANE SPAR VARNISH, per gallon	2.25
WHITE DOPE PROOF PAINT, per quart	.90

To save time, order direct from this ad, and remember your money cheerfully refunded if not satisfied.

If you are doing any building or repairing, you will be interested in our complete line of Aircraft SUPPLIES, MATERIALS and ACCESSORIES. Our CIRCULARS and PRICE LISTS are sent free on request. WRITE FOR YOUR COPIES NOW.

EAGLE AIRCRAFT SUPPLY CO., St. Johnsbury, Vt.

LIGHTPLANE

Supplies
Engineering Construction
Write for Our Free Bulletin
Sportsman Airplane & Supply Co.
319 West Boundary Hobart, Oklahoma

PROPELLERS

IMPROVED PROPELLERS

Bennett propellers are improved by using highly selected birch and walnut lamination. Blades are made stiffer and tipped with brass and stainless steel. A specially prepared waterproof varnish is used for finishing. Extra performance at a low price. Dealers write for our prices and discounts. List of complete line 10c.

BENNETT PROPELLER CO., Morganton, N. C.

PROPELLERS OF DISTINCTION

These laminated propellers are the most efficient made, regardless of name, make or price. Order from this ad, cash with order.

4' for Harley and Indian motors	$ 8.50
4' 6" Heath-Henderson, metal-tipped	8.50
6' Fords, Lawrence, Anzani, metal-tipped	9.98
8' for OX-5, hardwood, copper-tipped	16.98
MOTORS: Improved LeRhone 40	127.00
SHIPS: The 88 Trainer, flyaway	148.00
TIRES: 7.00-4 Air Wheels, including hubs	14.00

Information, includ. leather-bound Flying Manual, 25c

HIBBS FORT WORTH, TEXAS

LORENZEN PROPELLERS ARE WORLD FAMOUS

and are being used in Alaska, Canada, China, Europe, Hawaii, South Africa, and South America, as well as every State in the United States. That is just one reason why you should be using them, as we have the best. High performance at low cost.

Send dime for New Illustrated Catalog
LORENZEN PROPELLER CO.
Dept. P.A. Niles, Michigan

PROPELLERS

Special 4-bladed Propellers to give you more Speed and low C. G.

4'—4B—Ford A and T, Chevy, Star	$12.00
3'—4B—Henderson, H. D., Indian	6.00
6'—2B—Ford A and T, Chevy, Star	9.50
4½'—2B—Henderson	6.50
4'—2B—H. D., Indian	4.00

All of these propellers are cloth tipped. Send cash with order for prompt service.

RETZ AERO SHOP Farmland, Indiana

BOOKS

Get your start in the fast-growing
COMMERCIAL AVIATION INDUSTRY

New ocean routes soon starting. America's fastest-growing industry. Our booklet, "Wings of Commerce," lists over one hundred different occupations in this field, salaries paid, apprenticeships, promotions, how to qualify and apply. Lists all airline companies in U.S., Canada, Mexico, Central and South America. Information is complete. Price 20c postpaid.

CONTINENTAL SALES CO.
Box 344-B Indianapolis, Ind.

Aviation Books

Complete Stock of Books on All Aviation Subjects.
Send for Catalog.
GOODHEART-WILLCOX
2009 So. Michigan Ave., P.A. 2, Chicago, Ill.

DESIGN YOUR OWN LIGHTPLANE

Let 1935 edition "LIGHTPLANE DESIGN" guide you with its concise FACTS and over 100 drawings.
APPROVED BY EXPERTS
Send $1.00 or Write for FREE Literature
GUARANTEE—Satisfaction or return book within 10 days and your dollar promptly refunded.

W. H. KORFF AERONAUTICAL ENGINEER Box 71-A Mt. Vernon, Ill.

AERO BLUE BOOK

gives specifications of over 350 different airplanes ranging from 20 to 7,000 h.p. and nearly 100 aero engines. Also present second-hand market value of popular ships. Only information of its kind ever compiled. Almost priceless to students, engineers, dealers and flyers. FREE! If you order now, your choice of "How to Choose a Flying School" or "Points on Buying a Used Airplane." Send now!

NATIONAL DISTRIBUTORS
922 Pine St., St. Louis, Mo.

$1.00 postpaid.

INSTRUCTION

Solo Time

$3.00 PER HOUR

Dual $6 per hour. Air-cooled.
Licensed ships. Experienced Instructors.
Send stamp for Folder.
BARNES FLYING SERVICE
Municipal Airport Wichita, Kansas

For Complete Information on the
FREE FLYING TRAINING
given by the Army Air Corps, send for our booklet, "WINGS OF THE ARMY." Flying Cadets are paid a salary while learning, and get one year's training with 250 hours solo flying. Booklet tells how to qualify and apply. Prepared by a veteran of the Air Corps. Price 20c postpaid. Booklet, "WINGS OF THE NAVY," gives same information on Navy aviation. Price 20c.

CONTINENTAL SALES CO.
Box 344-B Indianapolis, Ind.

AVIATION!!

AIR-MINDED Young Men interested in entering the field of Aviation as Apprentices. Write, enclosing stamp, to—
MECHANIX-UNIVERSAL AVIATION SERVICE
Dept. B
13291 Ardmore Detroit, Mich.

MODEL AIRPLANES (Ready Built)

FINISHED MODELS
Modern and wartime airplane models built to order. Fine construction; lacquered and rigged properly. Wing-spans 8 inches to 7 inches. Smooth and glossy finish guaranteed. Name your model. Price—$1.25 each. (Seaplanes, amphibians, and autogiros, $1.50 each.) No C. O. D. orders. Canadian and Foreign, 20 percent extra. Satisfaction guaranteed. Please print your name and address.

Actual Boeing Model

MUELLER BROS. 28 Peach Street Buffalo, N. Y.

MODEL KITS AND PLANS

FINEST and MOST COMPLETE

6" to 8" SOLID KITS 15c PREPAID

Contents of Kit: ALUMINUM COWL, HEAVY CAST ALLUM. PROP, TURNED WHEELS, INSIGNIA, CEMENT, ALL PARTS CLEARLY PRINTED ON FINE QUALITY BALSA, FULL SIZE PLAN, IN AN ATTRACTIVE BOX. PROMPT SHIPMENT GUARANTEE.

B/J:XF-J-2, STINSON RELIANT, KNIGHT TWIST, VANCE FLYING WING, CLARK GA-43

AMERICAN MODEL AIRPLANE MFG.
1810 Broadway Brooklyn, N. Y.

Advertise in this Directory. # BUYER'S DIRECTORY Rates: $5.00 per inch.

FINEST and MOST COMPLETE
6" to 8" SOLID KITS 15c PREPAID
Contents of Kit: ALUMINUM COWL, HEAVY CAST ALLUM. PROP, TURNED WHEELS, INSIGNIA, CEMENT, ALL PARTS CLEARLY PRINTED ON FINE QUALITY BALSA, FULL SIZE PLAN, IN AN ATTRACTIVE BOX. PROMPT SHIPMENT GUARANTEE.
THE BOEING XP-936, CURTISS GOSHAWK, BEECHCRAFT, NORTHROP GAMMA
AMERICAN MODEL AIRPLANE MFG.
1810 Broadway Brooklyn, N. Y.

BOEING P12F
MODEL BUILDERS—HERE'S A BUY!
Modeled after a popular army plane. 14 in. long. 20 in. wing span. Kit contains: Spun aluminum cowling, celluloid wheels, semi-carved prop., celluloid cylinders, for engine colored dope, insignias, U.S. Army letters, rubber, cement, etc.
Price $2.00 P.P. No Stamps Please.
BETHLEHEM MODEL AIRCRAFT
712 N. New St., Bethlehem, Penna.

MODEL BUILDERS
Get one of these 3-in-one kits. Kits include: Full size plans for Sparrow Hawk F9C2, Curtiss Swift, and Goshawk F11C2. All are 12 in. wing span models. Not the ordinary "cheap" 12 in. models, but well engineered models.
Price of 3-in-1 Kit $1.00
Postage 10c. No Stamps Please.
BETHLEHEM MODEL AIRCRAFT
712 N. New St., Bethlehem, Penna.

25c KITS 40c
All kits contain plenty of cement, wood, paper, bent wire parts, full size plans, printed ribs, formers, etc.
12" Lockheed Vega, Flying model, postpaid.....40c
12" Howard "IKE," Flying model, postpaid.....40c
12" Puss Moth, Flying Model, postpaid.....25c
12" Kellet Autogiro, solid model, postpaid.....25c
9¾" Wedell Williams Racer, solid model, pp.....25c
8½" Gee Bee Racer, solid model, postpaid.....25c
LENNON MODEL AERO CLUB
15 Lennon St., Dept. P-3, Providence, R. I.

24-INCH FLYING SCALE MODEL KITS, 50c
Northup Sky Chief, Fairchild "22," Hall Spring Field Racer, New Monocoupe D-145, Stinson "A," Contest Flyer, S.P.A.D. "13," Goshawk F-11-C-2, Boeing F-4-B-4 and 3, Fokker D-VIII, Fokker D-VII, Waco "D" Pursuit. Flying Kits, 10c to $4.00. Printed parts; instructions, step for step, in building; full-size, detailed plans. List Kits and Supplies, 3c stamp.
Always Something New—Modelcraft—The Leading Model Airplane Supply House of the West
Quality MODELCRAFT First
2125 W. 54th St. Los Angeles, Calif.

CLIMBIN' WILLIE
and will he climb? Ribs and formers ready-cut (all planes). 18" all weather, gull wing, U.S. Air Force Pursuit that streaks. 50c—money back guarantee. Extra 20" flying—Bernard, Swift, Dewoitine 500, Howard Mike, Lotnicze PZL-1 at $1.25. Boeing P12-F, Fokker D17, Curtiss P6-E at $1.75—others. Stamps for lists only. Dealers write—
Model Airplane Specialties
Highland Park, Illinois

Boys! **FREE OFFER**
Complete Kit to Build Model *See*
LOS ANGELES DIRIGIBLE *Page 129*
SKYWAY MODEL AIRCRAFT SUPPLY CO.
7 Fuller Ave. Floral Park, N. Y.

15 INCH FLYING MODEL KITS POSTAGE 10c EA. 15c EACH

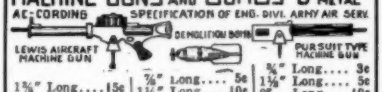
Boeing Bellanca-Aeronca Fairchild "22" SE5
Monocoupe 110 Curtiss Swift Howard Ike
(All 8 Kits $1.75 Postpaid No Stamps)
KITS CONTAIN Cement, wheels, finished prop., finished parts, printed balsa, etc.
Dealers Wanted
SUPER MODEL AIRCRAFT CO.
1245 S. 58th Ave. Cicero, Ill. Dept. 5
16-IN. BOEING FIGHTER

MODEL AIRPLANE PARTS

PROPELLERS
DIE CAST METAL

3 BLAD.			2 BLAD.		
1½"	Dia.	10c	2"	Dia.	10c
2⅛"	Dia.	15c	2½"	Dia.	15c
4"	Dia.	25c	3"	Dia.	20c
6"	Dia.	50c	4"	Dia.	25c
7"	Dia.	70c	5"	Dia.	30c
8"	Dia.	80c	6"	Dia.	35c

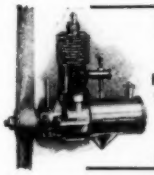
Aircraft & Marine Model Co.
2180 Nostrand Ave.
Brooklyn, N. Y.
Postage 3c Each

MACHINE GUNS AND BOMBS DIECAST METAL
ACCORDING SPECIFICATION OF ENG. DIVI. ARMY AIR SERV.


1⅜"	Long....	15c	⅞"	Long....	5c
2"	Long....	20c	1¼"	Long....	10c
			1½"	Long....	10c
			¾"	Long....	3c
			1½"	Long....	5c
			2"	Long....	10c

Postage 3c Each
Guns and Bombs are equipped with mounting.
AIRCRAFT & MARINE MODEL CO.
2180 Nostrand Ave. Brooklyn, N. Y.

Model Air Motors
READY TO RUN
Motors, 3-cyl., ⅜"x⅜"..$2.00
Tanks, 2½"x30".....$3.00
Motor and Tank $4.85
Tank holds 100 lbs. air.
Motor turns 16" prop.
Flies 6-ft. model.
GEO. DOBRUSIN
1335 So. California
Chicago, Ill.


HURLEMAN ARISTOCRAT
MODEL AIRPLANE
MOTORS-SPARK COILS-PLUGS
Write for Prices — Include 3c Stamp for Folder
Manufactured Solely By
WALTER HURLEMAN, INC.
1428 W. Bristol St., Phila., Pa.

GASOLINE POWERED MODELS
New 1935 Loutrel Aero Motor
The perfect engine for model planes and speed boats requiring a small, light, high speed power plant, with marvelous power, smoother operation, easier starting and absolute reliability.
It has what is lacking in most small motors, that is—Durability.
Price Now $15.00 Complete, Postpaid
Send dime for literature on motor, planes, ignition, etc.
LOUTREL SPECIALTY CO.
785 Prospect Pl. at Nostrand Ave., Brooklyn, N. Y.

MODEL AIRPLANE SUPPLIES

EMPTY TUBES
Effective January 1, 1935, the following changes will be made in the prices of our 1 oz. tubes. All prices are F.O.B. Chicago. Increased manufacturing and material costs have forced us to make this change.
1 Gross—1 oz. Tubes.....$2.50 F.O.B.
Shipping weight 9 lbs.
½ Gross—1 oz. Tubes.....$1.35 F.O.B.
Shipping weight 5 lbs.
We supply U.S. ARMY—U.S. NAVY letters, German Crosses, print plans from your drawings, etc. Write for quotations.
G-E MODEL SUPPLY CO., 1311 Wade St., Chicago

For Rock Bottom BALSA Prices and
FREE OFFER
See Page 122
We Pay Postage on All Orders Over 75c
NOW READY! New Price List for
DEALERS - CLUBS - SCHOOLS
Buy Direct from the Manufacturer
IMPERIAL MODEL AERO SUPPLY
416 McDonald Ave. Brooklyn, N. Y.

MODEL SUPPLIES

—BUILD TWICE AS MANY MODELS AT MY NEW LOW PRICES
—SEND FOR FREE LIST—
JACK KNOBLE 128 SO. 18TH AVE. MAYWOOD, ILLINOIS

VALUES!

Balsa 18" lengths					
1/16x1/16	..35	for 5c	Rub. ⅛ flat, 36 ft...		10c
1/16x1/8	..30	for 5c	Jap Tissue, 6 sh....		10c
1/8x1/8	..25	for 5c	Wheels 1" pr. 5c; 1⅝"		7c
1/32x2	.. 8	for 10c	Banana Oil, 2 oz....		8c
1/16x2	.. 8	for 10c	Pt.		45c
1/8 x2	.. 6	for 10c	Insignia Sht. 12 pr.		9c
Cl. Cement, 2 oz...		10c			

Add 10c postage.
Send 3c stamp for price list and FREE offer.
LENNON MODEL AERO CLUB
15 Lennon St., Dept. P-3, Providence, R. I.

BALSA
- 150 strips, assorted sizes.
- 15 sheets, assorted sizes.
- 10 propeller blocks, assorted sizes.
- 18-in. lengths—175 items—standard sizes.
- enough balsa to build 18 or more large models.
- satisfaction guaranteed—finest quality obtainable.
- all the above sent postpaid for one dollar.
- write for balsa assortment No. 2—prompt shipment.

Presque Isle Model Aircraft Company
926 West Sixth St., Dept. P-4, Erie, Penna.

PATENTS

UNPATENTED IDEAS CAN BE SOLD
I tell you how and help you make the sale. Free particulars. (Copyrighted)
WRITE W. T. GREENE
927 Barrister Bldg. Washington, D. C.

INVENTORS
Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for new FREE book, "Patent Guide for the Inventor," and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. CLARENCE A. O'BRIEN, Registered Patent Attorney, 315-Q Adams Building, Washington, D. C.

PATENTS
PERSONAL SERVICE
Let me act as your personal, confidential representative in Washington on all your patent problems. Delays of even a few days in protecting your ideas, or the slightest carelessness in handling your patent papers, may easily be very costly. My personal service assures speedy action and strictest confidence. Send immediately for my free 72-page booklet, "How to Get Your Patent."
L. F. Randolph, 372-D Victor Bldg., Washington, D. C.

MISCELLANEOUS

BUILD A FRONT DRIVE!
The details for building a real front wheel drive, forracing or sport use are now available to you. With blueprints on this car which is built without the extensive machine work found in cars of this type, using your 4 cyl. motor and other car parts it can be built most economically.
Edward A. Borntraeger
3450 N. Marshfield Ave. Chicago, Ill.

OLD COINS
WANTED
$5.00 to $2500.00 each paid for old coins.
Buying catalogue 10c.
BOB COHEN
Dept. 24 Muskogee, Okla.

WORLD WAR SOUVENIRS 1914-1918
For 6c in stamps I will mail you an imported Gnome 165 piston ring used on Nieuport 28 pursuit plane during war. Useful for paper weight or:
Nieuport 28 struts.....$1.00
Nieuport 28 covered ailerons.....$2.50
Vickers machine gun.....$15.00
Gnome cylinders.....50c
Send 3c postage for list of 4,000 items.
MARVIN A. NORTHROP AEROPLANE CO.
Minneapolis, Minnesota

DIRECTORY

PYROIL REDUCES FRICTION
Keeps valves free, protects pistons, gears, shafts from wear, scoring and seizing. Increases R.P.Ms. Write for amazing Pyroil air feats. Mfrd., Patd. and Guartd. by Pyroil Co., W. V. Kidder, Pres., 566 LaFollette Avenue, La Crosse, Wisconsin, U. S. A.

Genuine **PYROIL** LUBRICATION PROCESS

AVIATOR
Chrome ring and solid nickel silver bracelet. Name and address engraved free.
50c EACH
Send M.O.—else wrap coin carefully—give size or send string. Above ring in sterling silver $1.
P. A. R. Co., 305 22nd St. Galveston, Tex.

INTERNATIONAL AIRCRAFT MARKINGS
NAVAL or MILITARY
FOR CLUB ROOM or DEN
PAINTED ON REAL WING FABRIC
SIZE 15"x15"—SILVER BASE
FIVE DIFFERENT MARKINGS FOR $1.00
POSTPAID
MENTION PARTICULAR COUNTRIES YOU WISH
No Stamps Please
SOUTHWEST SUPPLY
110 WOODWORTH CT. LOS ANGELES, CAL.

AT LAST! A REAL POCKET RADIO
Can actually be carried in your pocket or purse! No tubes, batteries—nothing to wear out. Simply clip to anything made of metal for clear beautifully toned reception. Only one control -- gets all stations within 50 to 100 miles distant! No aerial needed! Complete with tiny phone—absolutely nothing else to buy. Send only $1.00 and pay postman $1.95 plus postage, or send $2.99 (M. O., currency, check) and we will send Postpaid. Complete ins. included. Guaranteed. Send your order now! **Tinytone Radio Co., Dept. P.A., Kearney, Nebr.**

CLASSIFIED

TECHNICAL BOOKS WANTED on aviation subject. Write N. B., Box 135, Greenlawn, L. I., N. Y.

USED AIRPLANES and GLIDERS $40 and up. Literature 10c. Continental Sales, Box 344B, Indianapolis, Ind.

NEW—Wright Gypsy engine. Brand new, in crate, ready for shipment. $350. Guaranteed. R. J. Wenger, 6718 McKinley Ave., Los Angeles, Calif.

LATEST BOAT SENSATION—20-lb. Mead "Ki-Yak" . . . the snappiest thing afloat. Assemble it easily from complete factory-cut kit; best buy in the market. Free—$6 Paddle given with first Ki-Yak purchased in your town—hurry! Rush 10c for catalog. MEAD GLIDERS, 15 South Market, Dept. EC-2, Chicago.

Barter and Exchange

Rate: 3 cents per word

FOR SALE or trade, Szekely 45 h.p. motor, new type cylinders and crankcase. Aeronca E-107 with prop. Anzani 35 h.p. fan-type motor suitable for ice sled. All motors in A-1 shape. Interested in airwheels and instruments. Make us an offer.—Aero Trades Co., Box 3002, Madison, Wis.

WANTED—1- or 2-place lightplane. Have Air-Camper fuselage and parts (wood), also radio parts, and cash.—W. A. Cain, Box 26, Dos Palos, Calif.

NB 8, a side-by-side high-wing monoplane with 80 h.p. air-cooled motor, refinished in red and white, chrome struts, airwheels, landing lights, ship nearly new. Will trade for another airplane or will accept automobile on trade. Terms. —Jim Kukla, Western Hills Airport, Cincinnati, Ohio.

TRADE your crack-up or worn-out airplane for credit on new Fords, any model, or good used automobiles.—Western Hills Airport, Cincinnati, Ohio.

MID-WING monoplane built under licensed instructors. Factory-like workmanship, steel-tube fuselage, tail group less motor. Will take any motor up to 50 h.p., also a cyl. mag., Anzani 5-cyl. less mag. and carb. New Heath prop. What have you for part or all? Prefer late car or OX job.—Leo Grasso, 1030 Chestnut St., Newton Upper Falls, Mass.

OX-5 American Eagle, Millerized, D.H. wheels. Plane dismantled at present. Will sell or trade for good automobile.—Chin Non, 209 West Main St., Lewistown, Mont.

SALE OR TRADE—OX Challenger 2 POLB. Ship 400 hours, motor 250. Alemite Miller Action, Scintilla mag. with booster. Jadson ferrochrome exhaust valves, and bronze exhaust guides. 50 hours since top overhaul. 30-pound baggage compartment, 30x5 wheels. Empennage just recovered. Fuselage and wing covering fair. $350 or trade in automobile, or what have you? —Ira J. Sellers, Jr., Quinlan Castle, Birmingham, Alabama.

FOR SALE or trade—Wright-powered Curtiss Robin. Fine condition.—Zeb Grubb, Grubb Motor Co., Lexington, N. C.

TRADE for cash or what have you?—American Eaglet two-place fuselage, factory welded. Never used or covered.—Fred B. Staeben, Fond du Lac, Wisconsin.

WHAT am I offered for a two-place Aeromarine Klemm, 1931 model, low-wing, less motor?— Eberhardt Walter, 9 Mill St., Walterboro, S. C.

TRADE Air-Camper and motor. Excellent condition. Airwheels, split landing-gear, Flightex fabric, all instruments, aluminum head and extras for good car.—Raymond Daggett, Sheldon, Iowa.

EAGLEROCK—$190 or late car; OX-Bird for air-cooled; Robin for car. Send 20c for list of hundreds of others.—Box 456, Athens, Ohio.

HEATH pontoons, undersize, suitable for glider, twenty-five-dollar tenor banjo. Will trade for power-driven tools, electric motors. Ruckstell Aluminum head Model A Ford, twelve dollars, cash.—J. Higgins, Richfield Springs, N. Y.

WANTED—A pair of 26x3 or 24x4 wheels, tires, and tubes. A tachometer, speed indicator, altimeter. Must be in A-1 condition. Will trade a set of ribs and partly-constructed fuselage. Can be powered by motorcycle engine.—R. L. Stuart, 52 National St., Santa Cruz, Calif.

SWAP compressed-air motor for unused kits, supplies, plans—preferably C-D., model gas motor.—S. Krebs, 1817 Ferry St., Easton, Pa.

WILL TRADE cracked Monoprep Velie motor for a 1932 or '33 light car.—Rita Klaus, 80½ Thomas St., Newark, N. J.

WANTED—OX-5 Bird wings, two upper and one lower right. Also motor-mount with radiator. Will trade 16 h.p. Lockwood outboard motor with boat.—Zigamond Sajkowicz, 22 Howard St., Norwich, Conn.

STAR conversion, two-cyl. 40 h.p. air-cooled motor, R 2 monoplane, one-place. Want radio or machinery.—Bob Retz, Farmland, Ind.

HAVE 1930 Ford roadster with radio. Want plane. Prefer licensed job. Crack-up considered.—Bob Retz, Farmland, Ind.

MECHANIC, age 21, will exchange work for A&E license and board and lodging. 15 months' ground school experience.—Robert Mattison, 1025 Fifth St., Brookings, S. D.

WILL TRADE home-study aviation course and Aircraft Year Book, 1934, for Harley 45.—Fred Schwartz, Jr., Winfield, Ill.

TRADE—13½ complete volumes German "Flugsport" magazine, Jan., 1920, to May, 1933, for amateur short-wave radio transmitter apparatus. What have you?—Carl Fastje, Denison, Iowa.

WANTED—Either a Harley or Indian motor or swap.—L. Schneider, St. Marys, Ohio.

HAVE two motorcycles to trade for one or will sell both.—Miller, P.O. Box 358, Kokomo, Ind.

HARLEY-DAVIDSON motorcycle, 1928, A-1 shape. Will trade for Austin coupe in good condition or lightplane.—Kenneth Mace, Garnett, Kansas.

Garros

(Continued from page 129)

time he was confined to locked and guarded quarters. Whenever he was permitted to walk around the prison camp for exercise he was forced to report to the guard room every half hour and write his name on a record showing the time of his signature.

During Garros' imprisonment, another famous French pilot was sent to the camp where Garros was imprisoned. He was Lieutenant Marchal, who made the World War's longest military flight—from the French front to Berlin where he bombarded the German capitol with propoganda literature. He had made the flight with the full realization that he would never be able to fly the 800 odd miles and return.

Marchal's flight was a sacrifice flight. It had no military value but did do much to upset the confidence and morale of the smug citizens of Berlin. They reasoned if the French could bomb them with paper they would soon be bombing them with bombs the same as the Gothas were making short flights across the Channel and bombing London.

When Marchal's gas supply gave out he landed and was promptly sent to the strictest and most efficiently guarded prison camp. Here he and Garros laid careful plans to accomplish the impossible—escape. Both had won the distinction of doing the impossible in aviation—why not in a prison camp? They did. They made their way into Holland and finally England.

END

BRUCE SMITH
WILLIAM STIEGLITZ
AERONAUTICAL ENGINEERS
Complete airplanes and component parts designed and stress analysed.
Suite 312, Clark-Howard Building, Chicago, Ill.
Rogers Park 7148

Governors

(Continued from page 96)

Upon rapid opening of the throttles, the low pitch of the propeller allows the engines to overspeed a small amount during the time that the governor is making the change in pitch—three or four seconds—but this is an advantage rather than a detriment.

And then, single-engine operation is facilitated. The maximum engine speed and power are now always available at the reduced airplane speed that occurs when one of the engines is not turning out its full power. The governor does not allow the good engine to overspeed because of a low pitch setting, and the good engine at least keeps up cruising power immediately after the other engine loses power and while the pilot is sizing up the situation. Full power is available by opening the throttle.

Transport operation involves long glides from high altitude when approaching port, glides of 60 or 70 miles with the engines pulling. The governor control permits this with the best use of the engine so that during the glide, the propellers automatically go to low pitch when the governors maintain cruising speed on the glide. After landing, the ship is taxied in low pitch which gives better control.

END

Airy Chat

(Continued from page 74)

sue. This will be a real find for our model readers and photo collectors.

* * *

AIRWAY MAPPING has been put on a quantity production basis by the Bureau of Air Commerce. More than 100 workers, new airplanes, and other equipment have been purchased, and plans have been made for the completion of the job by June 30, 1935. This is for the preparation of the Bureau's sectional airway map series for the entire United States. Speeding up of the compilation and checking was made possible by a grant of $508,000 from the Public Works Administration. This will be of great benefit to all who have to do with aviation.

Eighty-seven maps will be required for covering the United States and 28 of these maps have already been printed and put into circulation. Each airway map is about 40 by 20 inches and is drawn to a scale of about eight miles to the inch. They show geographical features and landmarks, rivers, lakes, cities, towns, railroads, main highways, race tracks, and golf courses, and over these features are those which are particularly significant to pilots such as beacon-lights, radio stations, and magnetic variations. This will be good news to airmen and we are glad to make the announcement.

J. B. R.

deHaviland Model

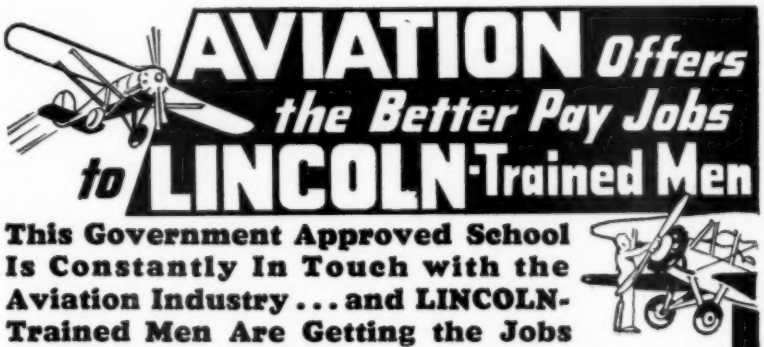
(Continued from page 106)

dried in place cement the top wing to them. Insert the outer wing struts to the third rib from the end of the wings, then rig the model with white thread. Add all details, gun, insignias, control horns, wind generator, windshield, etc.

Have the cowling turned on a lathe or purchase one. Build up the motor as shown on plate 4. If the model is to fly, cement the motor in so it will not turn, and cement a hollow shaft through it for the "prop" shaft. If the model is for looks and not flying, mount it so it will turn with the propeller. The propeller is easily carved by following the steps on plates 4 and 5. All controls are drawn on with pen and ink, although they may be made movable with a small amount of effort and altering of construction. The model is powered with six strands of ⅛-inch flat rubber.

The model should be tried out the first time over tall grass or weeds to avoid damage in case that it is not properly balanced. The rubber should be wound up to about half the full number of turns and then launched horizontally with a medium forward speed.

END



AVIATION Offers the Better Pay Jobs to LINCOLN-Trained Men

This Government Approved School Is Constantly In Touch with the Aviation Industry . . . and LINCOLN-Trained Men Are Getting the Jobs

The aviation industry demands and is quick to recognize properly trained Pilots and Mechanics. That's why there is a steady demand for LINCOLN graduates! Ten more LINCOLN-trained men have found good pay jobs with such prominent concerns as the Glenn L. Martin Co., builders of Martin Bombers; the Istanbul-Angora Airlines of Istanbul, Turkey; the Ecuadorian Air Corps; Bendix-Stromberg Carburetor Co.; U. S. Marines and others. LINCOLN'S constant contact with the Aviation Industry is for the purpose of placing its graduates in trusted positions.

Now Is the Time for YOU to Start your aviation training at LINCOLN. Join these men who will be among the fortunate, well-trained Pilots and Mechanics of Aviation's near future. Be ready for the big pay opportunities in Central and South America, as well as in the United States.

Future Bright with Thousands of New Jobs

The Government's great aviation development program, for which 10 million dollars was recently appropriated, promises a future in which thousands of new jobs will be available for properly trained men. Uncle Sam is planning to spend millions more to make America first in the air. Let LINCOLN training have you ready to fill one of these good jobs!

Modern Equipment—Finest Training Learn to Fly All Types of Planes

There's no guesswork about your aviation training here at LINCOLN. We know what every student needs and have the equipment and expert instructors to give it to him. Government-Licensed Instructors and unexcelled equipment for teaching primary and advanced flying, which includes night flying, blind flying, acrobatics, cross country flying, etc. Master Airplane and Engine Mechanics course prepares you for mechanic's position.

High wing and low wing monoplanes, biplanes, cabin planes and others are used to assure you complete experience. Both flight and ground training under Government Supervision.

24 Years' Successful Experience as mechanics' trade school; 14 years' success teaching aviation. That's the record which recommends LINCOLN, the World's Best Known School, to you! Get the right start for a successful career in aviation, at LINCOLN.

Mail Coupon Now!

LINCOLN is ready and waiting to put you a step ahead toward a fascinating career in Aviation. Mail coupon now for further information.

LINCOLN AIRPLANE & FLYING SCHOOL
234E Aircraft Bldg.
Lincoln, Nebraska

LINCOLN AIRPLANE & FLYING SCHOOL
234E Aircraft Bldg., Lincoln, Nebraska

YES! I want further information about LINCOLN'S unexcelled training for success in Aviation.

Send it at once, without obligation.

Name.....

Address.....

City.....

State..... Age.....

BUFFALO PUBLIC LIBRARY BUFFALO INSTITUTE OF TECHNOLOGY